

SYSTEM, METHOD AND DEVICES FOR ACCESSING OR SHARING A DIGITAL DOCUMENT IN A  
PEER-TO-PEER COMMUNICATION NETWORK

BACKGROUND OF THE INVENTION

5           The present invention relates to the accessing or to the sharing of a digital document in a communication network of distributed type commonly referred to as having "peer-to-peer" topology, and more particularly to accessing a data item of a digital document, from any station of the network, on the basis of another data item of the same digital document.

10           As from the last few years, peer-to-peer networks have become an alternative to the client-server systems widely used up till now. This is because, due to their distributed architecture, peer-to-peer networks make it possible to share a high quantity of digital data between a large number of users, without this necessitating a costly infrastructure.

15           In practice, in a peer-to-peer network, each station plays the role of client and server. Thus, each station can request a data item or a digital document from any other station of the network and the exchange of data may be carried out directly from one station to another.

20           In what follows, the term "document or digital data item" applies equally to images or digital videos, or to digital texts.

          Generally, the same digital document comprises at least first and second data items connected to each other according to an edition relationship of hierarchical type and/or quality in terms of resolution, version, language, size or content. In practice, the original data item (referred to here as second data  
25   item of the digital document to share) has the highest resolution and the data item having the lowest resolution is referred to as a thumbnail (and corresponding here to the first data item of the digital document to share).

          In the case in which the digital document is an image, the original data item corresponds to the original image, that is to say at full resolution, and  
30   the thumbnail corresponds to an image of lower resolution.

          In the case in which the digital document is a video, the original data item corresponds to the sequence of original images and the thumbnail

corresponds, for example, to the first image of the video at a lower resolution than the resolution of the original video.

Currently the distribution of data increasingly relies on peer-to-peer networks due to their low-cost installation, due to the presence of very  
5 numerous computers connected to the network, and also due to the development of broadband connections.

However, peer-to-peer networks are unstable. This is because client devices (and consequently server devices) connect and disconnect periodically to the network, thus rendering the presence of data highly unpredictable.  
10 Furthermore, the addresses of client and/or server devices are unpredictable and liable to be different at each connection.

The result of this is that access to content on a communication network of peer-to-peer type still constitutes a considerable difficulty since the lag in obtaining the data item is no longer simply due to the time necessary for  
15 retrieval of the data as in the conventional client-server topology, but also in the time for searching for a server device having that data item. According to the topology of the peer-to-peer network concerned, this searching phase may or may not be negligible.

To remedy these drawbacks, one solution consists of using a central  
20 server which guarantees a minimum quality of service. This then referred to as a hybrid peer-to-peer network.

In practice, sharing a digital document over a peer-to-peer communication network consists of the following known succession of steps:

- selecting the document to share;
- 25 - associating a unique identifier making it possible to find the location of the document on the network;
- calculating a thumbnail on the basis of the original data item;
- updating an index table at the central server by associating an identifier of the shared document with one (or several) station(s), each of these  
30 stations being server for the document.

This known succession of steps is used in most peer-to-peer networks to share a document with a community of users, that is to say that

anyone may access the shared document provided that person knows the identifier. This is then referred to as public sharing.

By contrast, it is possible to share a document with a group of friends and to restrict the access to that document to that group of friends. This then  
5 referred to as restricted access sharing (private sharing).

In this case, the private sharing of a document necessitates two additional steps:

- selecting the recipients;
- sending notification to each of those recipients so as to inform them  
10 that a new document has been shared.

In practice, the present invention is in no way modified whether one or the other of these sharing systems is used. In what follows, the present invention is described in the case in which the document is publicly shared.

The stations of a peer-to-peer network are in general computers  
15 connected to the network through the wired network. Nevertheless, any type of apparatus may connect to that network. For example, a mobile telephone or a personal digital assistant. According to their capacities (memory, calculation capacity) it is possible for these apparatuses not to play their role of servers (for example mobile telephones). These cases are referred to as thin stations which  
20 only provide the client function of a station, that is to say a passive role which consists of looking at the documents or digital data which are sent to them and of sharing but however not serving the data.

One of the problems to be solved is thus to share digital documents from any digital apparatus, whether that apparatus be a station in its own right,  
25 or a thin station.

The sharing mechanism of the prior art, described above, implies that the station from which the sharing arises plays the role of server. In the opposite case, that is to say when the sharing arises from a thin station, only the thumbnail is actually shared, the original data item being stored on the thin  
30 station which cannot serve it. In fact, that original data item is accessible once it has been stored on a station in its own right, playing the role of server.

The problem to solve can thus be described by means of the following example:

Further to some photographs having been taken, a user wishes to share them (or some of them) from a thin station (typically a mobile telephone).  
5 When another user requests the original data item via the document identifier, that original data item is not accessible via the sharing system.

If we now have the photograph taker making that original data item accessible from another station (different from the thin station with which he shared the thumbnail), the problem is thus to match the original data item with  
10 the thumbnail (allocation of the same identifier) such that the station which stores that original data item can serve a request comprising that identifier.

In other words, the problem is to synchronize the two versions of different resolution (referred to here as first and second data items of a first document) of a digital document when the two versions are shared at different  
15 times or from different stations (referred to here as first and second documents).

Once a document has been shared, that is to say that the thumbnail and the original data item are associated with a unique identifier, any user may access the original data item on the basis of that identifier. This implies that the identifier is associated with the thumbnail before the thumbnail has been  
20 retrieved by another user. If this is not the case, the search mechanism described earlier cannot be used since the identifier is not known to the station which sends out the request.

For example two users exchange a thumbnail of a digital document without the identifier being attributed to that thumbnail. In this example, the  
25 sending user takes a photograph with a digital camera and sends a thumbnail of that photograph to the camera of the receiving user via a short-range radio link for example. As a variant, the photograph is sent at the original resolution, but the camera of the receiving user cannot store that photograph due to a lack of memory space. At that time, the receiving apparatus generates a thumbnail on  
30 the basis of the original image received. It may be noted that the thumbnail of the receiving user may be different from that generated by the camera of the sending user since the sub-sampling processes are not necessarily the same.

The same type of scenario can also be imagined on the basis of mobile telephones or any other digital apparatus, including in particular micro-computers (sending out of the thumbnail by email). Similarly, the data (original and thumbnail) may be taken from apparatuses which cannot be equated to stations of a peer-to-peer communication network since they do not have sufficient storage capacities and/or cannot remain continuously connected to the network. Thus the invention is used when the sending user downloads the original data and the thumbnail onto a station and the receiving user downloads the thumbnail onto another station of the network.

10           The problem to solve thus consists of associating a unique identifier with the thumbnail (first data item of a first digital document) and the original digital data (second data item of the first digital document) stored on the station of the sending user and to associate that same identifier with the thumbnail (first data item of a second document) stored on the station of the receiving user.

15           That receiving user can thus access all the versions of the digital document on the basis of that identifier, according to the search mechanism conventionally used in peer-to-peer sharing systems.

          In other words, the problem consists of synchronizing the two documents (different resolutions and different sources) of the same digital document, that is to say that the same unique identifier is to be attributed to them as soon as those documents are accessible.

          Several systems currently exist which describe synchronization of digital documents in the context of collaborative editing. These systems enable editing of a document to be performed remotely, the system synchronizing the different modifications made to the document.

          The problem is nevertheless different in the case of sharing a multi-resolution document since the versions of the data are no longer modified once shared and the user receives the new version only when he has requested it.

          For example, US-A-5949551 describes a system for high quality printing of multi-resolution documents. Further to sending an image on paper by post, the system digitizes the image so as to create an original digital version of the image and a version at lower resolution (thumbnail). Next, the thumbnail is

sent to the client or to an intermediary machine. The client may retrieve that thumbnail from that intermediary if he specified this at the time of making his order from the printing service. The system next calculates a time limit at the end of which the image at full resolution must be sent to the client. This time  
5 depends on several parameters: time limit imposed by the client, the resource of the communication network. During this period, the full resolution image is sent by a second means of communication, different from the first means used for sending the thumbnail. If sending was not possible within the given time, the system detects the problem and reports an item of information to the client.

10 This system does not require synchronization of the two image versions which are generated by the same machine. This is because the same identifier is associated with the thumbnail and the original data item from the time of their creation. This identifier is sent to the client or to the intermediary machine at the same time as the thumbnail. This identifier makes it possible to  
15 access the original image which is available from the machine which generated that image. Thus the client has knowledge of that machine as soon as he receives the thumbnail and the identifier.

## SUMMARY OF THE INVENTION

20 The present invention provides a solution precisely to this problem of synchronization in which the client does not know the machine enabling the document to be accessed, nor the identifier of the document to share.

It relates to a digital document system in which a digital document in a communication network is shared between a plurality of stations, said system  
25 comprising:

- a first station having a first digital document comprising a thumbnail data item and an original data item;
- a second station having a second digital document comprising a thumbnail data item; and
- 30 - a center station comprising:
  - calculating means for calculating signatures of the thumbnail data items of the first and second digital documents;

- comparing means for comparing the calculated signatures of the thumbnail data items; and

- transmitting means for transmitting information for accessing the original data item of the first digital document to the second station according to a result of the comparison.

The present invention also relates to a method of controlling a center station capable of communicating with a plurality of stations sharing a digital document in a communication network, characterized in that it comprises the following steps:

a) receiving a thumbnail data item comprised in a first station and a thumbnail data item comprised in a second station;

b) calculating a signature from each of the received thumbnail data items;

c) comparing the calculated signatures of the received thumbnail data items, and

d) transmitting information for accessing an original data item related to the thumbnail data item to the second station according to a result of the comparison.

According to one embodiment, the thumbnail data item comprised in the second station is generated in the first station.

According to another embodiment, color histograms each based on the thumbnail data items is calculated as the signatures in said calculating step.

For example, a comparison is performed based on a difference and a threshold calculated from the thumbnail data items in said comparing step.

In practise, said communication network is a peer-to-peer network.

For example, the first station is a digital camera apparatus and generates the original data item.

The present invention also relates to a method of controlling a station capable of sharing a digital document in a communication network, characterized in that it comprises the following steps:

i) generating an original data item;

ii) generating a thumbnail data item from the original data item;

iii) transmitting the thumbnail data item to the other station; and  
iv) receiving an access from said other station to the original data item based on the thumbnail data item.

The present invention also relates to a method of controlling a station  
5 capable of sharing a digital document in a communication network, characterized in that it comprises the following steps:

- 1) receiving a thumbnail data item from other station;
- 2) transmitting the received thumbnail data item to a center station;
- 3) receiving, from the center station, information for accessing the  
10 original data item related to the thumbnail data item determined based on the thumbnail data item.

The present invention also relates to a device for accessing a digital document on a communication network, characterized in that it comprises means adapted to implement a method as described above.

15 The present invention relates to a computer program stored on an information carrier, said program comprising instructions enabling the implementation of a processing method as described above, when this program is loaded and run by a computer system.

## 20 BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will appear in the light of the following detailed description and drawings in which:

- **Figure 1A** shows the general architecture of a system for sharing digital documents according to a first embodiment;
- 25 - **Figure 2A** shows a device implementing the part of the invention dedicated to a central server according to the first embodiment;
- **Figure 3A** shows block diagrams illustrating the information stored in tables of the central server according to the first embodiment;
- **Figure 4A** shows a device implementing the part of the invention  
30 dedicated to a user station according to the first embodiment;
- **Figure 5** shows block diagrams illustrating the organization of the data stored in tables of a user station;



- **Figure 6** shows a block diagram illustrating the creation of a request containing an identifier, from a user station;

- **Figure 7** shows a block diagram illustrating the delivery of a document by a user station according to an identifier;

5       - **Figure 8** shows a block diagram illustrating the mechanism of searching for a digital document on the basis of an identifier;

- **Figure 9A** shows a block diagram illustrating the creation of a request containing a thumbnail, from a user station according to the first embodiment;

10       - **Figures 10A and 11A** show block diagrams illustrating the mechanism of searching for a digital document on the basis of a thumbnail according to the first embodiment;

- **Figure 12A** shows a block diagram illustrating the mechanism for sharing a new document according to the first embodiment;

15       - **Figure 13A** illustrates the general steps of the method of sharing a digital document of photograph type in accordance with the invention according to the first embodiment;

20       - **Figure 1B** is a block diagram illustrating the general architecture of a device for sharing digital data implementing the invention according to a second embodiment;

- **Figure 2B** is a diagram of the programmable apparatus implementing the part of the invention dedicated to the central server according to the second embodiment;

25       - **Figure 3B** is a diagram of the organization of the information stored on the central server according to the second embodiment;

- **Figure 4B** is a diagram of the architecture of the stations according to the second embodiment;

- **Figure 9B** is a diagram of the part of the invention dedicated to a thin station according to the second embodiment;

30       - **Figure 10B** is a diagram of the method of receiving a message sent in accordance with **Figure 9B** according to the second embodiment;

- **Figure 11B** is a diagram of the steps illustrating the part of the invention dedicated to the reference station according to the second embodiment; and

- **Figure 13B** is a diagram of the steps of the method of sharing a document of photograph type in accordance with the invention according to the second embodiment.

## DETAILED DESCRIPTION OF THE INVENTION

With reference to **Figure 1A**, the general architecture of a system for sharing digital documents implementing the invention is composed of a central server 100A and two stations 101A and 102A. These different entities are connected to each other by a communication network 104A such as the Internet.

The invention concerns a mechanism for searching for a digital document DD to share. For this, an index table, which makes it possible to access a shared document on the basis of its identifier Id, is advantageously used. This index table may be distributed or centralized. The preferred embodiment for implementation of the invention will be described on the basis of a search mechanism using a centralized table and stored on a central server.

Moreover, as explained earlier, the invention described here assumes that the original data item HR and a thumbnail TH are stored on a first station 101A and that another thumbnail TH2 calculated on the basis of the original data item HR2 is stored on a second station 102A.

It will also become apparent in what follows that the matching mechanism requires a systematic analysis of each entry of the index table. Such an analysis is unrealistic when the number of entries in that table becomes enormous (several thousands or even millions of entries). A variant of this algorithm consists of limiting the analysis to the entries which correspond to the data shared by the sending user or to the data served by a reference station attached to that sending user.

For this, on sending that original data item HR1 or the thumbnail TH1 to a receiving user 102A, the sending user 101A includes an item of information

for it to be identified. For example, the identifier of that sending user can be hidden in the header of the data item or of the document to share.

In what follows, **Figures 6, 7, 8 and 12A** explain the operation of a conventional system for searching for shared documents on the basis of their  
5 identifiers.

The role of the central server 100A is to centralize and temporarily store a certain number of items of information which will be described in more detail below. The central server 100A, which for example may be a microcomputer or a workstation, is continuously connected to the peer-to-peer  
10 network. Such a machine is described with reference to **Figures 2A and 3A**.

Stations 101A and 102A may for example be a microcomputer or a workstation. These apparatuses fully play the role of a station i.e. the role of client and of server. For this, they have sufficient memory and calculation capacities to implement the part of the invention dedicated to them.

15 The apparatus 100A comprises a communication bus 209A to which there are connected:

- a central processing unit 202A (microprocessor) which controls the exchanges between the various components of the apparatus,
- a read only memory 201A, able to contain the programs,
- 20 - a random access memory 205A comprising registers 208A adapted to store variables and parameters created and modified during the execution of the programs, with reference to **Figures 9A, 10A and 11A**.
- a hard disk 203A able to contain the aforementioned programs,
- a disk drive 211A adapted to receive a diskette 210A and to read or  
25 write thereon data processed or to be processed according to the invention,
- a communication interface 206A connected to a communication network 104A, for example the Internet, the interface being able to transmit and receive data.

The communication bus affords communication and interoperability  
30 between the different elements included in the apparatus 100A or connected to it. The representation of the bus is non-limiting and, in particular, the central

processing unit is capable of communicating instructions to any element of the apparatus 100A directly or by means of another element of the apparatus 100A.

The executable code of each program enabling the programmable apparatus to implement the methods according to the invention may be stored,  
5 for example, on the hard disk 203A or in read only memory 201A.

According to a variant, the diskette 210A can contain data as well as the executable code of the aforementioned programs which, once read by the apparatus 100A, are stored on the hard disk 203A.

As a second variant, the executable code of the programs can be  
10 received by the intermediary of the communication network 104A, via the interface 206A, in order to be stored in an identical fashion to that described previously.

The diskettes can be replaced by any information carrier such as a compact disc (CD-ROM) or a memory card. Generally, an information storage  
15 means, which can be read by a computer or microprocessor, integrated or not into the apparatus, and which may possibly be removable, is adapted to store one or more programs whose execution permits the implementation of the method according to the invention.

More generally, the program or programs may be loaded into one of  
20 the storage means of the apparatus 100A before being executed.

The central processing unit 202A controls and directs the execution of the instructions or portions of software code of the program or programs according to the invention, the instructions being stored on the hard disk 203A or the read only memory 201A or in the other aforementioned storage elements.  
25 On powering up, the program or programs which are stored in a non-volatile memory, for example the hard disk 203A or the ROM 201A, are transferred into the RAM 205A, which then contains the executable code of the program or programs according to the invention, as well as registers for storing the variables and parameters necessary for implementation of the invention.

30 It should be noted that the communication apparatus comprising the device according to the invention can also be a programmed apparatus.

This apparatus then contains the code of the computer program or programs, for example fixed in an application specific integrated circuit (ASIC).

With reference to **Figure 3A**, the organization of the information stored on the central server 100A is described.

5           According to a preferred embodiment of the invention, the information concerning the shared documents or data, the requests awaiting response, and the information on the users and the stations will be centralized on the central server 100A. Nevertheless, the invention may be applied to a system which distributes this information (or part of it) to the stations 102A or  
10 others (reference station not shown).

The information stored on the central server is grouped into a look-up table, for example subdivided into four tables: a table of the users, a table of the stations, a table of the indices and a table of the requests.

Any user who wishes to share a document or data item is preferably  
15 registered with the central server for this, the user connects to the central server via a Web service or via a graphical application dedicated to the sharing system.

According to a preferred embodiment, the Web interface is used. The central server sends a form which the user fills in using a login name and a  
20 password.

According to a variant, during this procedure, the central server registers the station from which the user is connected, as being its reference station.

Of course, the user may access this registration information so as to  
25 modify, for example, its reference station. All this information is stored in the table of users. Furthermore the central server associates a unique identifier with the newly registered user.

The table of stations (IP address, etc.) contains the information making it possible to connect to the station on the basis of its identifier. This  
30 table is updated at each connection or disconnection of a registered station. This status of connection or disconnection is, among other things, one of the

key conditions which serve to determine whether a data item may be served or not.

The index table is empty when the system starts up. This table comprises an entry composed of four fields for each version of a document to share:

- the unique identifier of the shared document,
- the identifier of the version (first or second data item) of the shared document,
- a list of identifiers of stations which serve the version of the document,
- a local access path for the case in which the version of the document is stored on the central server.

Two identifiers are associated with each shared document: one, unique, to identify the document, and another to identify the version of that document (original version, thumbnail, etc.). The list of stations which serve a remote document is stored as well as the local path for access to that data item.

It should be noted that this index table is updated as soon as a new thumbnail is shared, as soon as a station no longer serves a version of a document and as soon as a station has just retrieved a new version of a shared document.

This centralized index table makes it possible to implement the conventional search mechanism in a peer-to-peer network described with reference to **Figures 6, 7 and 8**.

The table of requests temporarily stores the requests which cannot be served. The thumbnail, the identifier of the version of the document which is searched for and the identifier of the station which sent the request are stored in that table of requests.

With reference to **Figure 4A**, a programmable apparatus implementing the part of the invention dedicated to the stations 101A and 102A is described. This part of the invention is described with reference to **Figure 9A**.

Apparatuses 101A and 102A comprise a communication bus 409A to which there are connected:

- a central processing unit 402A (microprocessor) which controls the exchanges between the various components of the apparatus,

- a read only memory 401A, able to contain the programs,

- a random access memory 412A comprising registers 413A adapted  
5 to store variables and parameters created and modified during the execution of the programs, with reference to **Figures 9A, 10A and 11A.**

- a screen 403A for displaying data and/or serving as a graphical interface with the user, who will be able to interact with the programs according to the invention, using a keyboard 404A or any other means such as a pointing  
10 device (not shown), for example a mouse or an optical stylus,

- a hard disk 405A able to contain the aforementioned programs,

- a disk drive 406A adapted to receive a diskette 407A and to read or write thereon data processed or to be processed according to the invention,

- a communication interface 410A connected to a communication  
15 network 411A, for example the Internet, the interface being able to transmit and receive data.

The communication bus allows communication and interoperability between the different elements included in the microcomputer 101A, 102A or connected to it. The representation of the bus is non-limiting and, in particular,  
20 the central processing unit is able to communicate instructions to any element of the microcomputer 101A, 102A directly or by means of another element of that microcomputer.

The executable code of each program enabling the programmable apparatus to implement the processes according to the invention may be  
25 stored, for example, on the hard disk 405A or in read only memory 401A.

According to a variant, the diskette 407A can contain data as well as the executable code of the aforementioned programs which, once read by the apparatus 101A, 102A, are stored on the hard disk 405A.

As a second variant, the executable code of the programs can be  
30 received by the intermediary of the communication network 411A, via the interface 410A, in order to be stored in an identical fashion to that described previously.

The diskettes can be replaced by any information carrier such as a compact disc (CD-ROM) or a memory card. Generally, an information storage means, which can be read by a computer or microprocessor, integrated or not into the apparatus, and which may possibly be removable, is adapted to store one or more programs whose execution permits the implementation of the method according to the invention.

More generally, the program or programs may be loaded into one of the storage means of the apparatus 101A, 102A before being executed.

The central processing unit 402A controls and directs the execution of the instructions or portions of software code of the program or programs according to the invention, the instructions being stored on the hard disk 405A or the read only memory 401A or in the other aforementioned storage elements. On powering up, the program or programs which are stored in a non-volatile memory, for example the hard disk 405A or the ROM memory 401A, are transferred into the random access memory RAM 412A, which then contains the executable code of the program or programs according to the invention, as well as registers for storing the variables and parameters necessary for implementation of the invention.

It should be noted that the communication apparatus comprising the device according to the invention can also be a programmed apparatus. This apparatus then contains the code of the computer program or programs for example fixed in an application specific integrated circuit (ASIC).

With reference to **Figure 5**, the organization of the information stored on the stations 101A and 102A has been described.

The documents table enables a version of a document stored on the station to be accessed on the basis of the version and document identifiers. This table is used when the station receives a request in which those identifiers are specified. The response to a request is described with reference to **Figure 8**.

The thumbnails table makes it possible to retrieve the version and document identifiers locally on the basis of a selection made by the user via a graphical interface. This process is described with reference to **Figure 6**.



With reference to **Figure 6**, the method is described which makes it possible to request a version of a shared document.

The method commences with step S600 during which a user selects the document to retrieve, for example an image. For example, that selection  
5 may be made via a graphical interface which displays a set of thumbnails on the screen of the station. Each of these thumbnails corresponds to a shared document. The user selects one of these thumbnails and specifies the version of the document which he wishes to retrieve. The process interprets this information and generates a string of characters which uniquely identifies the  
10 version of that document in the table of thumbnails.

At step S601, the method retrieves the identifiers corresponding to that string and sends them to the central server (S602).

With reference to **Figure 7**, the method is described that makes it possible for a station to serve a version of a document. Further to a request  
15 sent by a requesting station (S700), the process extracts the identifiers (S701) of that request and extracts the access path of the table of data (S703). Step S704 consists of sending the data to the requesting station.

With reference to **Figure 8**, the mechanism of searching for a digital document is described. The method commences further to a request sent by a  
20 user from a station (S602). This request is composed of two identifiers defining the version of the data sought and the identifier of the station which sent the request (so as to be able to send the response to that station).

On reception of that request (S800), the central server extracts the identifiers of the document to share (S801) and searches for the entry of the  
25 index table which corresponds to those two identifiers (S802). Where this document is available locally ("access path" field filled in) (S803), the central server sends the document to the station (S804) and the method stops. In the opposite case, the list of the identifiers of the stations is extracted from the entry of the index table (S805). Next, the method retrieves the connection information  
30 of each of those stations from the table of stations (S806-S809). It may be recalled that all the stations referenced in that table are connected to the network. As soon as one of them disconnects, it informs the central server

which updates the table. The same applies for any new connection or as soon as the connection information of a station changes. This station information is temporarily stored in a list L (S810). If that list is empty (no station connected) (S812), the request is placed on standby until one of them connects (S813). In  
5 the opposite case, the central server sends the list L to the requesting station (S814).

When the station which sent the request receives the response, a process analyzes whether the response contains the requested document. If this is the case the search method terminates. If this is not the case, the station  
10 sends the request to each of the stations in turn of the list L extracted on the basis of the response.

The method stops when one of the stations serves the requested document.

With reference to **Figure 9A**, the process is described which makes it  
15 possible to request a version of a document to share. Note that at that time, the requesting station does not possess the identifier Id1 of the document to share DD1, HR1 but only the thumbnail TH2 of that document to share and the identifier of the user who provided him with that thumbnail TH2.

The method commences with step S900A during which a user  
20 selects the thumbnail TH2 to retrieve. For example, that selection may be made via a graphical interface which displays a set of thumbnails on the screen of the station. Each of these thumbnails TH corresponds to a shared document DD. The user selects one of these thumbnails and specifies the version of the document which he wishes to retrieve (S901A). Step S902A sends those  
25 thumbnails TH2 and the version identifiers to a station capable of serving it, for example, to the central server.

With reference to **Figures 10A** and **11A**, the method is described which enables a station to find the identifier Id1 of the requested document DD1 on the basis of its thumbnail TH1. According to a preferred embodiment, this  
30 station is the central server. Nevertheless, the different methods described below constituting the method may be executed on different stations, for example station 101A.

Further to a request sent out by a requesting station (S1000A), the process extracts the thumbnail TH2, the version identifier of the requested document and the user identifier (S1001A) of that request (according to a preferred embodiment) and calculates a signature for that thumbnail TH2 (S1002A). According to a preferred embodiment of the invention, this signature is a colors histogram calculated on the basis of the thumbnail TH2.

Steps S1003A-S1009A describe the mechanism for matching that thumbnail TH2 with the stored thumbnails TH1 of the documents to share (referenced in the table of the indices).

Step S1003A selects the entries of the table of the indices which were generated further to sharing of data coming from the user whose identifier is the one contained in the request. Where that identifier is not present in the request, all the entries of the table are considered.

Furthermore, only the entries corresponding to the version identifier, contained in the request, are considered.

Steps S1004A-S1009A describe the mechanism for matching between the signature S of the thumbnail TH2 received and the signature coming from the thumbnails TH1 referenced by the selected entries of the table of the indices. For this, a metric is defined between two signatures. In the case of colors histograms, a distance defined in M. J. Swain, D. H. Ballard, "Color Indexing", Inter. Journal of Comp. Vision, 7:1, pp 11-32, 1991. This distance has the value 1 if both signatures are equal and 0 otherwise. If the signature S is greater than a threshold (between 0 and 1), step S1007A is followed by the step S1008A which extracts the identifier of the data item of the entry in the corresponding index table. Of course, if the entry does not exist, the request is placed on standby. As soon as a new entry is generated, the process tests whether that new entry comprises the version and user identifiers contained in the request such that the process of **Figure 10A** can continue with step S1011A of **Figure 11A**. This step S1011A tests whether the version of the document is available on the central server. Where this document is available locally ("access path" field filled in), the central server sends the data item to the requesting station (S1012A) and the method stops. In the opposite case, the list

of the identifiers of the stations is extracted from the entry of the index table (S1013A). Next, the process retrieves the connection information of each of these stations from the table of stations (S1014A-S1019S). It may be recalled that all the stations referenced in that table are connected to the network. As soon as one of them disconnects, it informs the central server which updates the table. The same applies for any new connection or as soon as the connection information of a station changes. This station information is temporarily stored in a list L (S1017A). If that list is empty (no station connected) (S1020A), the request is placed on standby until one of them connects (S1021A). In the opposite case, the central server sends the list L to the requesting station (S1022A).

When the station which sent the request receives the response, a process analyzes whether the response contains the requested data item. If this is the case the search method terminates. If this is not the case, the station sends the request to each of the stations in turn of the list L extracted on the basis of the response. The method stops when one of the stations serves the requested document or data item. ;

Two variants may be added to this search mechanism. According to the first variant, the central server only sends the information concerning a sole station. According to the second variant, the central server sends an ordered list of those stations. The ordering is based on the connection capacities of those stations (bandwidth) or on the presence time of that station (connection time to the network evaluated for a period of time).

With reference to **Figure 12A**, the sharing of a document from a station is described. This sharing mechanism is used in a peer-to-peer sharing system comprising (or not comprising) the invention.

The document to share is stored locally on the station. First of all, the sending user 101A is authenticated at the central server by him stating his login and password (S1100A). The sending user 101A next selects the original data item or items to share (S1101A). For each of them, the process calculates a thumbnail TH1 (S1103A). The thumbnail TH1 is stored locally. The method also associates two identifiers Id (data item and version) with each of the thumbnails

TH1 (S1104A). The table of the thumbnails TH1 is updated (S1105A). Finally, a message is sent to the central server (S1107A). This message is composed of the identifiers and of the thumbnail TH1 of each of the documents DD to share.

5 A variant consists of sending only the thumbnail TH1 to the central server which calculates the identifiers Id. In this case, the identifiers Id are sent back the station 102A which sent out the request, once they have been generated by the central server. The station stores these identifiers in the table of the thumbnails TH.

10 When the central server receives the message of step S1107A, a process extracts the list of the identifiers (if they have been sent) and of the thumbnails. This step of course associates the data item and version identifiers if they have not been received. The thumbnails, their access paths and the identifiers are stored locally and the index table is updated. For this, a new entry  
15 comprises the identifier of the document, the identifier of the version and the local access path enabling the thumbnail to be accessed if the entry corresponds to a thumbnail. If the entry corresponds to an original data item, the field is not referenced.

20 With reference to **Figures 1A** and **13A**, the general steps are described of the sharing method according to the invention.

For example, a first sending user P1 exchanges a first data item TH1 of a document DD1 with a second receiving user P2. This action is illustrated by action F1. The exchange is free and uses no function in particular. For example, the sending user P1 takes a photograph with a digital camera and sends a  
25 thumbnail TH1 of that photograph to the camera of the receiving user P2 via a short-range radio link. As a variant, the photograph is sent at the original resolution HR1, but the camera of the receiving user cannot store that photograph due to a lack of memory space. At that time, the receiving apparatus generates a thumbnail TH2 on the basis of the original image  
30 received. It may be noted that the thumbnail of the receiving user P2 may be different from that generated by the camera of the sending user P1 since the sub-sampling processes are not necessarily the same.

It may also be that the camera of the receiving user P2 accepts the original image on his camera; the latter is then saved on the camera and corresponds to what is termed a second data item HR2 of a second digital document DD2. The obtainment of the corresponding thumbnail TH2 can then  
5 be made on station 102A of the receiving user P2.

The same type of scenario can also be imagined on the basis of a mobile telephone or any other digital apparatus, including in particular micro-computers (sending out of the thumbnail by email).

In our example, the receiving user P2 wishes to access the second  
10 data item HR1 of the first document DD1 further to that exchange. The second data item HR1 is for example the original data item at full resolution of the first document DD1 whereas the first data item is a thumbnail TH1 of lower resolution, which corresponds to a first edition relationship of hierarchical type between the first and second data items of the first digital document to share  
15 according to the invention.

The sending user P1 loads onto his station 101A the first TH1 and second HR1 data items of the first digital document DD1 (action F2). The first digital document DD1 is identified by a chosen identifier Id1. This is carried out either directly by the station 101A, or further to an exchange between the  
20 station 101A and the server station 100A, as illustrated by the arrow F4.

The receiving user P2 loads onto his station 102A the data item thus exchanged which corresponds here to a first data item TH2 of a second digital document DD2 (action F3), said first and second digital documents DD1 and DD2 being linked to each other according to a second chosen temporal and  
25 geographical edition relationship.

The receiving user P2 sends out a request to the peer-to-peer communication network according to the invention to obtain the identifier Id1 of document DD1 on the basis of the first data item (thumbnail) TH2 of the second document DD2. The request is sent to at least one station capable of serving  
30 the document DD1, here at the server 100A, station 101A or else a reference station 103A designated by the sending user (action F5). The request comprises at least the second data item TH2.

At station 101, the reference station 103A or the server 100A, the second data item TH2 is received and the first data items TH1 and TH2 of the first and second digital documents so obtained are compared.

In case of positive comparison, the identifier Id1 is attributed to the  
5 second digital document DD2.

At station 102A, the second data item HR1 of the first digital document DD1 is accessed from the second digital document DD2 so identified.

With reference to **Figure 1B**, and according to a second embodiment of the present invention, a device for sharing digital data implementing the  
10 invention is composed of a central server 100B, a thin station 101B, a reference station 102B and a requesting station (this station is the one from which a user requests a data item on the basis of its identifier). These different entities are connected by a communication network 104B such as the Internet.

The described invention does not directly concern the mechanism for  
15 searching. Thus the index table which enables a shared document to be accessed on the basis of its identifier may be distributed or centralized. The preferred embodiment for implementation of the invention will be described on the basis of a search mechanism using a centralized table.

The role of the central server 100B is to centralize and temporarily  
20 store a certain number of items of information described later. This machine, which for example may be a micro-computer or a workstation, is permanently connected to the peer-to-peer network. It is described in more detail with reference to Figures **2B** and **3B**.

The thin station 101B may for example be a micro-computer, a  
25 mobile phone, a personal digital assistant PDA or any other apparatus having wired or wireless communication means. In practice, this station does not require high storage or calculation capacities.

Finally, stations 102B and 103B may for example be a  
30 microcomputer or a workstation. These apparatuses fully play the role of a station i.e. the role of client and of server. For this, they have sufficient memory and calculation capacities to implement the part of the invention dedicated to them.

With reference to **Figure 2B**, a programmable apparatus implementing the part of the invention dedicated to the central server 100B is described. This part of the invention will be described with reference to **Figures 8 and 10B**.

5           The apparatus 100B comprises a communication bus 209B to which there are connected:

- a central processing unit 202B (microprocessor), which controls the exchanges between the various components of the apparatus,
- a read only memory 201B, able to contain the programs,
- 10           - a random access memory 205B comprising registers 208B adapted to record variables and parameters created and modified during the execution of the programs, in particular the counters i,p, and the list L with reference to **Figure 8**,
- a hard disk 203B able to contain the aforementioned programs,
- 15           - a disk drive 211B adapted to receive a diskette 210B and to read or write thereon data processed or to be processed according to the invention,
- a communication interface 206B connected to a communication network 104B, for example the Internet, the interface being able to transmit and receive data.

20           The communication bus affords communication and interoperability between the different elements included in the apparatus 100B or connected to it. The representation of the bus is non-limiting and, in particular, the central processing unit is capable of communicating instructions to any element of the apparatus 100B directly or by means of another element of the apparatus 100B.

25           The executable code of each program enabling the programmable apparatus to implement the processes according to the invention may be stored, for example, on the hard disk 203B or in read only memory 201B.

          According to a variant, the diskette 210B can contain data as well as the executable code of the aforementioned programs which, once read by the  
30           apparatus 100B, will be stored on the hard disk 203B.

          As a second variant, the executable code of the programs can be received by the intermediary of the communication network 104B, via the



interface 206B, in order to be stored in an identical fashion to that described previously.

The diskettes can be replaced by any information carrier such as a compact disc (CD-ROM) or a memory card. Generally, an information storage  
5 means, which can be read by a computer or microprocessor, integrated or not into the apparatus, and which may possibly be removable, is adapted to store one or more programs whose execution permits the implementation of the method according to the invention.

More generally, the program or programs may be loaded into one of  
10 the storage means of the apparatus 100B before being executed.

The central processing unit 202B controls and directs the execution of the instructions or portions of software code of the program or programs according to the invention, the instructions being stored on the hard disk 203B or the read only memory 201B or in the other aforementioned storage elements.  
15 On powering up, the program or programs which are stored in a non-volatile memory, for example the hard disk 203B or the ROM 201B, are transferred into the RAM 205B, which then contains the executable code of the program or programs according to the invention, as well as registers for storing the variables and parameters necessary for implementation of the invention.

It should be noted that the communication apparatus comprising the  
20 device according to the invention can also be a programmed apparatus. This apparatus then contains the code of the computer program or programs, for example, fixed in an application specific integrated circuit (ASIC).

With reference to **Figure 3B**, the organization of the information  
25 stored on the central server 100B has been described.

According to a preferred embodiment of the invention, the information concerning the shared documents, and the information on the users and the stations will be centralized on the central server 100B. Nevertheless, the invention may be applied to a system which distributes this information (or  
30 part of it) to the stations 102B or 103B.

The information stored on the central server is grouped into a look-up table which may be subdivided into three tables:

- a first table termed "Table of users";
- a second table termed "Table of stations";
- a third table termed "Table of indices";

Any user who wishes to share a document is registered with the  
5 central server. For this, the user connects to the central server via a Web  
service or via a graphical application dedicated to the sharing system.  
According to a preferred embodiment, the Web interface is used. The central  
server sends a form which the user fills in using a login name and a password.  
Furthermore, during this procedure, the central server registers the station from  
10 which the user is connected as being its reference station (this station having to  
play the role of data server). Of course, the user may access this registration  
information so as to modify, for example, its reference station. All this  
information is stored in the table of users. Furthermore the central server  
associates a unique identifier with the newly registered user.

15 The table of stations (IP address, etc.) contains the information  
making it possible to connect to the station on the basis of its identifier. This  
table is updated at each connection or disconnection of a registered station.  
This status of connection or disconnection is, among other things, one of the  
key conditions which serves to determine whether a data item may be served or  
20 not.

It may also be noted that only the stations in their own right are  
registered in that table.

In what follows, it will not be specified whether a station is thin or not.  
By default, when a station is referred to, it will be implicit that the station plays  
25 the role of client and server.

The fact of separating the registrations of the users from those of the  
machines makes it possible for each user to access the data sharing system  
from any station.

The index table is empty when the system starts up. This table  
30 comprises an entry composed of four fields for each version of a shared item of  
data:

- the unique identifier of the shared document,

- the identifier of the version (first or second data item) of the shared document,
- a list of identifiers of stations connected which serve the version of the document,
- 5       - a local access path for the case in which the version of the document is stored on the central server.

Two identifiers are associated with each shared document: one, unique, to identify the document, and another to identify the version of that document (original version, thumbnail, etc.).

10       It should be noted that this index table is updated:

- when a thumbnail is shared,
- when a post no longer serves a version of a document,
- when a station has just retrieved a new version (other than the thumbnail) of a shared document.

15       This centralized index table makes it possible to implement the conventional search mechanism in a peer-to-peer network described by **Figures 6, 7 and 8.**

With reference to **Figure 4B**, a programmable apparatus implementing the part of the invention dedicated to the thin station 101A and to the stations 102A and 103A is described. This part of the invention is also  
20       described with reference to **Figures 6, 9B and 11B.**

The apparatus 101B, 102B or 103B comprises a communication bus 409B to which there are connected:

- a central processing unit 402B (microprocessor), which controls  
25       the exchanges between the various components of the apparatus,
- a read only memory 401B, able to contain the programs,
- a random access memory 412B comprising registers 413B adapted to record variables and parameters created and modified during the execution of the programs, in particular the counters i,j, and the variables I and  
30       J, with reference to **Figures 9B and 11B.**
- a screen 403B for displaying data and/or serving as a graphical interface with the user, who will be able to interact with the programs according

to the invention, using a keyboard 404B or any other means such as a pointing device, for example a mouse or an optical stylus,

- a hard disk 405B able to contain the aforementioned programs,
- a disk drive 406B adapted to receive a diskette 407B and to read or write thereon data processed or to be processed according to the invention,
- a communication interface 410B connected to a communication network 411A, for example the Internet, the interface being able to transmit and receive data.

The communication bus allows communication and interoperability between the different elements included in the microcomputer 101B, 102B or 103B or connected to it. The representation of the bus is non-limiting and, in particular, the central processing unit is able to communicate instructions to any element of the microcomputer 101B, 102B or 103B directly or by means of another element of that microcomputer.

The executable code of each program enabling the programmable apparatus to implement the methods according to the invention may be stored, for example, on the hard disk 405B or in read only memory 401B.

According to a variant, the diskette 407B can contain data as well as the executable code of the aforementioned programs which, once read by the apparatus 101B, 102B or 103B, is stored on the hard disk 405B.

As a second variant, the executable code of the programs can be received by the intermediary of the communication network 411B, via the interface 410B, in order to be stored in an identical fashion to that described previously.

The diskettes can be replaced by any information carrier such as a compact disc (CD-ROM) or a memory card. Generally, an information storage means, which can be read by a computer or microprocessor, integrated or not into the apparatus, and which may possibly be removable, is adapted to store one or more programs whose execution permits the implementation of the method according to the invention.

More generally, the program or programs may be loaded into one of the storage means of the apparatus 101B, 102B or 103B before being executed.

The central processing unit 402B controls and directs the execution  
5 of the instructions or portions of software code of the program or programs according to the invention, the instructions being stored on the hard disk 405B or the read only memory 401B or in the other aforementioned storage elements. On powering up, the program or programs which are stored in a non-volatile memory, for example the hard disk 405B or the ROM 401B, are transferred into  
10 the RAM 412B, which then contains the executable code of the program or programs according to the invention, as well as registers for storing the variables and parameters necessary for implementation of the invention.

It should be noted that the communication apparatus comprising the device according to the invention can also be a programmed apparatus. This  
15 apparatus then contains the code of the computer program or programs for example fixed in an application specific integrated circuit (ASIC).

With reference to **Figure 5**, the organization of the information stored on the stations 102B and 103B is described, that is to say on a station having the role of server of shared data.

20 The table of data enables a version of a data item stored on the station to be accessed on the basis of the version and data identifiers. This table is used when the station receives a request in which those identifiers are specified. The response to a request is described with reference to **Figure 7**. This table is not present on the thin stations which do not serve data.

25 The thumbnails table makes it possible to retrieve the version and document (data) identifiers locally on the basis of a selection made by the user via a graphical interface. This process is described with reference to **Figure 6**.

With reference to **Figure 6**, the method commonly used has been described which makes it possible to request a version of a shared document  
30 on the basis of its identifiers. The method commences with step S600 during which a user selects the image to retrieve. For example, that selection may be made via a graphical interface which displays a set of thumbnails on the screen

of the station. Each of these thumbnails corresponds to a shared document. The user selects one of these thumbnails and specifies the version of that data item which he wishes to retrieve. The method interprets this information and generates a string of characters which uniquely identifies the version of that document in the table of thumbnails. Step S601 retrieves the identifiers  
5 corresponding to that string and sends them to the central server (S602).

With reference to **Figure 7**, the method commonly used has been described which makes it possible for a station to serve a version of a document. Further to a request sent by a requested station (S700), the process  
10 extracts the identifiers (S701) of that request and extracts the access path of the table of data (S702). Step S703 consists of sending the data to the requesting station.

With reference to **Figure 8**, the mechanism searching for a digital document based on identifiers is described (the mechanism used in most sharing systems comprising a centralized table of indices). The method  
15 commences further to a request sent by a user from a station (S602). This request is composed of two identifiers defining the version of the document sought and the identifier of the station which sent the request (so as to be able to send the response to that station).

On reception of that request (S800), the central server extracts the identifiers of the document (S801) and searches for the entry of the index table which corresponds to those two identifiers (S802). Of course, if the entry does not exist, the request is placed on standby. As soon as a new entry is generated, the method tests whether that new entry comprises the document  
25 and version identifiers of the request such that the method continues with step S803. Where this data item is available locally ("access path" field filled in) (S803), the central server sends the data item to the station (S804) and the method stops. In the opposite case, the list of the identifiers of the stations is extracted from the entry of the index table (S805). Next, the method retrieves  
30 the connection information of each of those stations from the table of stations (S806-S809). It may be recalled that all the stations referenced in that table are connected to the network. As soon as one of them disconnects, it informs the

central server which updates the table. The same applies for any new connection or as soon as the connection information of a station changes. This station information is temporarily stored in a list L (S810). If that list is empty (no station connected) (S812), the request is placed on standby until one of them  
5 connects (S813). In the opposite case, the central server sends the list L to the requesting station (S814).

When the station which sent the request receives the response, a method analyzes whether the response contains the requested document. If this is the case the search method terminates. If this is not the case, the station  
10 sends a request (comprising the two identifiers and the identifier of the requesting station) to each of the stations in turn of the list L extracted on the basis of the response. The method stops when one of the stations serves the requested data.

Two variants may be added to this search mechanism.

15 1) The central server only sends the information concerning only a single station.

2) The central server sends an ordered list of those stations. The ordering is based on the connection capacities of those stations (bandwidth) or on the presence time of that station (connection time to the network evaluated  
20 for a period of time).

With reference to **Figure 9B**, the part of the invention dedicated to a thin station has been described. The method consists of sharing a document. This document is stored locally on the station. First of all, the user is authenticated at the central server by him stating his login and password  
25 (S900B). The user next selects the original data item or items to share (S901B). For each of them, the method calculates a thumbnail (S903B). The thumbnail is stored locally. Finally, the thumbnails are sent to the central server (S906B).

With reference to **Figure 10B** the method of receiving a message sent in accordance with **Figure 9B** is described (S906B).

30 On the basis of the message received (S1000B), the central server extracts the list of the thumbnails (S1001B). The thumbnails are stored locally (S1002B). An identifier is associated with each of these thumbnails (S1003B)

and the index table is updated (S1004B). For this, a new entry is created in that table for each of the thumbnails received. Each of these entries comprises the identifier of the document, the identifier of the version and the local access path enabling the thumbnail to be accessed. Next, from the table of users, the central  
5 server extracts the identifier of the reference station of the user who sent the message (S1005B). The user thus serving information designating the reference station. Finally, a new message is created and sent to that reference station (S1006B). This message contains the thumbnails and identifiers of all the thumbnails received by the central server.

10 With reference to **Figure 11B**, the part of the invention dedicated to the thin station has been described. This part consists of synchronizing the original data (not yet accessible on the network) with the thumbnails shared and referenced in the index table. It may be recalled that the reference station received the thumbnails and the identifiers of the images newly shared from the  
15 central server. The number of these thumbnails is J.

The user commences by being authenticated at the central server (S1100B). Next he selects the original data stored on the station. It may be noted that if that data was created from a thin station (mobile phone, or any other apparatus), that original data is loaded on the reference station in a  
20 predefined folder, for example, at the time of the installation of the invention on that station (S1101B). Furthermore, it is possible for that data not to correspond to the thumbnails received. At that moment, the method described below is put on standby until other data is loaded onto the station. For reasons of clarity, in what follows it is considered that each thumbnail may be matched with a loaded  
25 data item, this in no way limiting the invention.

For each of the J thumbnails received, the method calculates a data item characteristic of the content of that data item termed in what follows the signature S (S1102B). For example, in the case of images, a color histogram is calculated on the basis of the thumbnail.

30 For each of the I original data items loaded, the method also calculates that signature (S1104B). It may be noted that, when the signature is



a color histogram, the signature is extracted on the basis of the original image reduced to the resolution of the thumbnail.

This signature is next compared to each of the J signatures associated with the thumbnails received (S1106B). For this, a metric is defined  
5 between two signatures i and j.

In the case of color histograms, a distance defined in M. J. Swain, D. H. Ballard, "Color Indexing", Inter. Journal of Comp. Vision, 7:1, pp 11-32, 1991 may for example be used. This distance has the value 1 if both signatures are equal and 0 otherwise. For intermediate values, if the distance is greater than a  
10 threshold, step S1106B is followed by step S1107B which associates the data identifier matching data item j with the current original data item i. As a variant, the method may be caused to request a confirmation of matching between an original data item and two thumbnails in case the decision could not be taken on the basis of the values of that distance.

15 Once that method of matching has terminated, that is to say that each thumbnail has been fitted with an original data item, the station sends the central server a message comprising the list of the identifiers (document and version identifiers) and the identifier of the reference station (S1113B). In this manner, the central server updates the table of indices by adding new entries to  
20 that table. Thus, the central server is informed about the fact that a new station can serve original data items.

With reference to **Figures 1B** and **13B**, the general steps have been described of the method of sharing a document of photograph type in accordance with the invention:

25 For example, further to some photographs having been taken with a camera AP1, a sending user wishes to share those photographs (or some of them) from a thin station 101B (typically a mobile telephone TM1).

The thin station may also be a computer OR1 which does not belong to him, such as a publicly accessible computer. In this case, the user  
30 temporarily loads the photographs of the camera AP1 onto the public computer OR1 in order to send them to a station of the network, for example the central server 100B.

Thus, the station 101B sends the first data item TH1 (a thumbnail) of a first digital document DD1, to the central server 100B. He may also send the identifier Id1 of the document DD1 or the latter may be created by the central server 100B. Station 101B also sends an item of information for designating a reference station 102B, typically its user identifier. This action is illustrated by the arrow F1 with reference to **Figure 13B**.

The second data item HR1 of the digital document DD1 is not yet available on the network. The second data item HR1 is for example the original data item at full resolution of the first document DD1 whereas the first data item is a thumbnail TH1 of lower resolution, which corresponds to a first edition relationship of hierarchical type between the first and second data items of the first digital document DD1 to share according to the invention.

The central server 100B which receives, among others, that designation information item, selects the reference station 102B to which it sends the first data item TH1 of the first digital document and its identifier Id1 (action F2).

This selection may also be made according to a selection criterion linked to a characteristic of the reference station 102B, for example its time of presence or the bandwidth available at that station.

The central server 100B may make available the first data item TH1 of the first digital document DD1 and its identifier Id1 to any user of the network who requests this and in particular station 103B.

The photographer who returns to his reference station 102B, downloads from his camera AP1, from his memory card or from his mobile phone TM1, a second data item HR2 of a second digital document DD2 (action F3). The first and second digital documents DD1 and DD2 are connected to each other here by a second chosen geographical and temporal edition relationship.

Station 102B deduces therefrom a first data item TH2 of that second digital document DD2. It should be noted that the second data item HR2 of the second document DD2 is probably the same as the second data item HR1 of the first document DD1 whereas the first data item TH2 of the second document

may be different from the first data item TH1 of the first document according to the subsampling methods performed by the different apparatuses AP1 and 102B.

Thus, to confirm that the two second data items of the two  
5 documents DD1 and DD2 are indeed identical, station 102B performs an operation of comparing the first data item TH1 of the first document DD1 which it received from the station 100B with the first data item TH2 of the second document DD2.

In case of positive comparison, the identifier Id1 of the first document  
10 DD1 is attributed to the second digital document DD2. Station 102B then sends confirmation of reception of the second data item HR1 of document DD1 to the central server 100B (action F4).

The latter then knows that the original data item HR1 of the first document DD1 is available and may thus be served.

15 If a user requests the original data item HR1 from a station 103B via the identifier of the document Id1 (action F5), the central server 100B may deliver the original data item HR1 of document DD1, from or via the reference station 102B.

CLAIMS

1. A digital document system in which a digital document in a communication network is shared between a plurality of stations, said system  
5 comprising:

- a first station (101A, 101B) having a first digital document (DD1) comprising a thumbnail data item (TH1) and an original data item (HR1);

- a second station (102A, 103B) having a second digital document (DD2) comprising a thumbnail data item (TH2); and

10 - a center station (100A, 100B) comprising:

• calculating means for calculating signatures of the thumbnail data items (TH1, TH2) of the first and second digital documents (DD1, DD2);

• comparing means for comparing the calculated signatures of the thumbnail data items (TH1, TH2); and

15 • transmitting means for transmitting information for accessing the original data item (HR1) of the first digital document (DD1) to the second station (102A, 103B) according to a result of the comparison.

2. A method of controlling a center station (100A, 100B) capable of  
20 communicating with a plurality of stations sharing a digital document in a communication network, characterized in that it comprises the following steps:

a) receiving a thumbnail data item (TH1) comprised in a first station (101) and a thumbnail data item (TH2) comprised in a second station (102A, 103B);

25 b) calculating a signature from each of the received thumbnail data items (TH1, TH2);

c) comparing the calculated signatures of the received thumbnail data items (TH1, TH2), and

30 d) transmitting information for accessing an original data item (HR1) related to the thumbnail data item (TH1) to the second station (102A, 103B) according to a result of the comparison.

3. A method according to claim 2, wherein the thumbnail data item (TH2) comprised in the second station (102A, 103B) is generated in the first station (101A, 101B).

5           4. A method according to claim 2, wherein color histograms each based on the thumbnail data items (TH1, TH2) is calculated as the signatures in said calculating step.

10           5. A method according to claim 2, wherein a comparison is performed based on a difference and a threshold calculated from the thumbnail data items (TH1, TH2) in said comparing step.

15           6. A method according to claim 2, wherein said communication network is a peer-to-peer network.

            7. A method according to claim 2, wherein the first station is a digital camera apparatus and generates the original data item (HR1).

20           8. A method of controlling a station (101A, 101B)) capable of sharing a digital document in a communication network, characterized in that it comprises the following steps:

- i) generating an original data item (HR1);
- ii) generating a thumbnail data item (TH1) from the original data item (HR1);
- 25           iii) transmitting the thumbnail data item (TH1) to the other station; and
- iv) receiving an access from said other station to the original data item (HR1) based on the thumbnail data item (TH1).

30           9. A method of controlling a station capable of sharing a digital document in a communication network, characterized in that it comprises the following steps:

- 1) receiving a thumbnail data item (TH2) from other station;

2) transmitting the received thumbnail data item (TH2) to a center station (100A, 100B);

3) receiving, from the center station (100A, 100B), information for accessing the original data item (HR1) related to the thumbnail data item (TH1)  
5 determined based on the thumbnail data item (TH2).

10. A computer program stored in an information carrier, said program comprising instructions enabling the implementation of a processing method according to claim 2, when that program is located and executed by a  
10 computer system.

11. A computer program stored in an information carrier, said program comprising instructions enabling the implementation of a processing method according to claim 8, when that program is located and executed by a  
15 computer system.

12. A computer program stored in an information carrier, said program comprising instructions enabling the implementation of a processing method according to claim 9, when that program is located and executed by a  
20 computer system.

13. A device for accessing a digital document in a communication network characterized in that it comprises means adapted to implement a sharing method according to claim 2.  
25

14. A device for accessing a digital document in a communication network characterized in that it comprises means adapted to implement a sharing method according to claim 8.

30 15. A device for accessing a digital document in a communication network characterized in that it comprises means adapted to implement a sharing method according to claim 9.

1/20

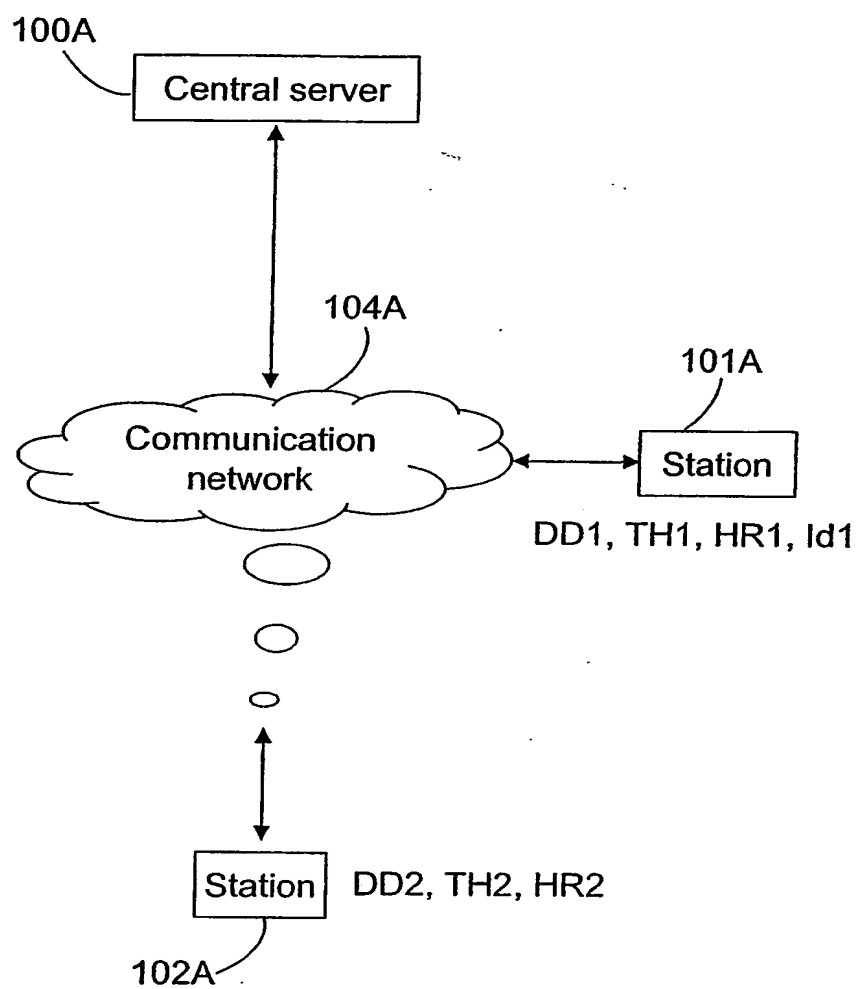


FIG. 1A

**THIS PAGE BLANK (USPTO)**



2/20

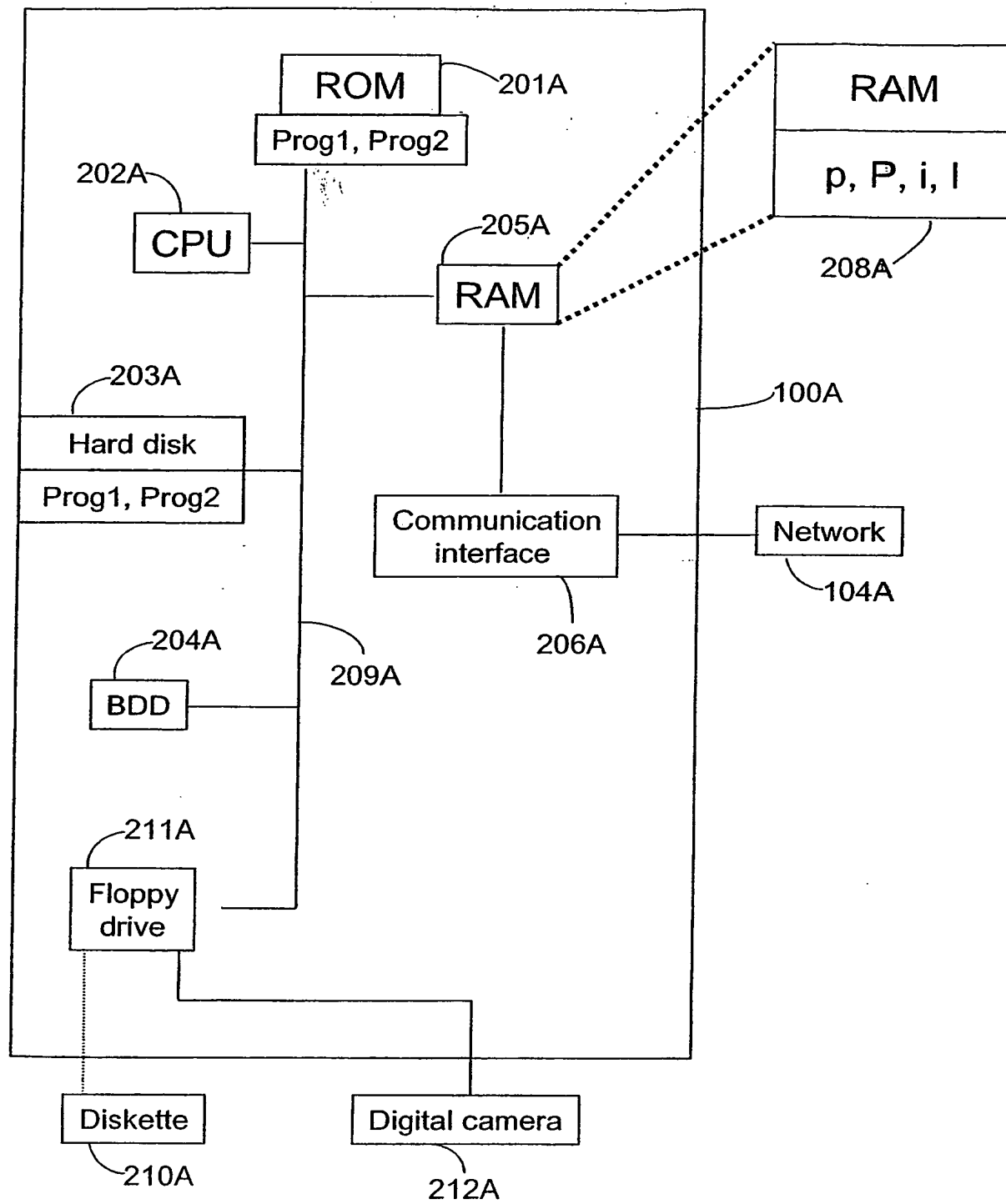


FIG. 2A

**THIS PAGE BLANK (USPTO)**

3/20

Table of users	
User Id	<ul style="list-style-type: none"><li>- Name</li><li>- Password</li><li>- Reference station Id</li></ul>

Table of stations	
Station Id	<ul style="list-style-type: none"><li>- Name</li><li>- IP Address</li><li>- Port</li></ul>

Table of indices			
Document Id	Version Id	Station Id	Access path

Table of requests		
Thumbnail	Version Id	Station Id

FIG. 3A

**THIS PAGE BLANK (USPTO)**

4/20

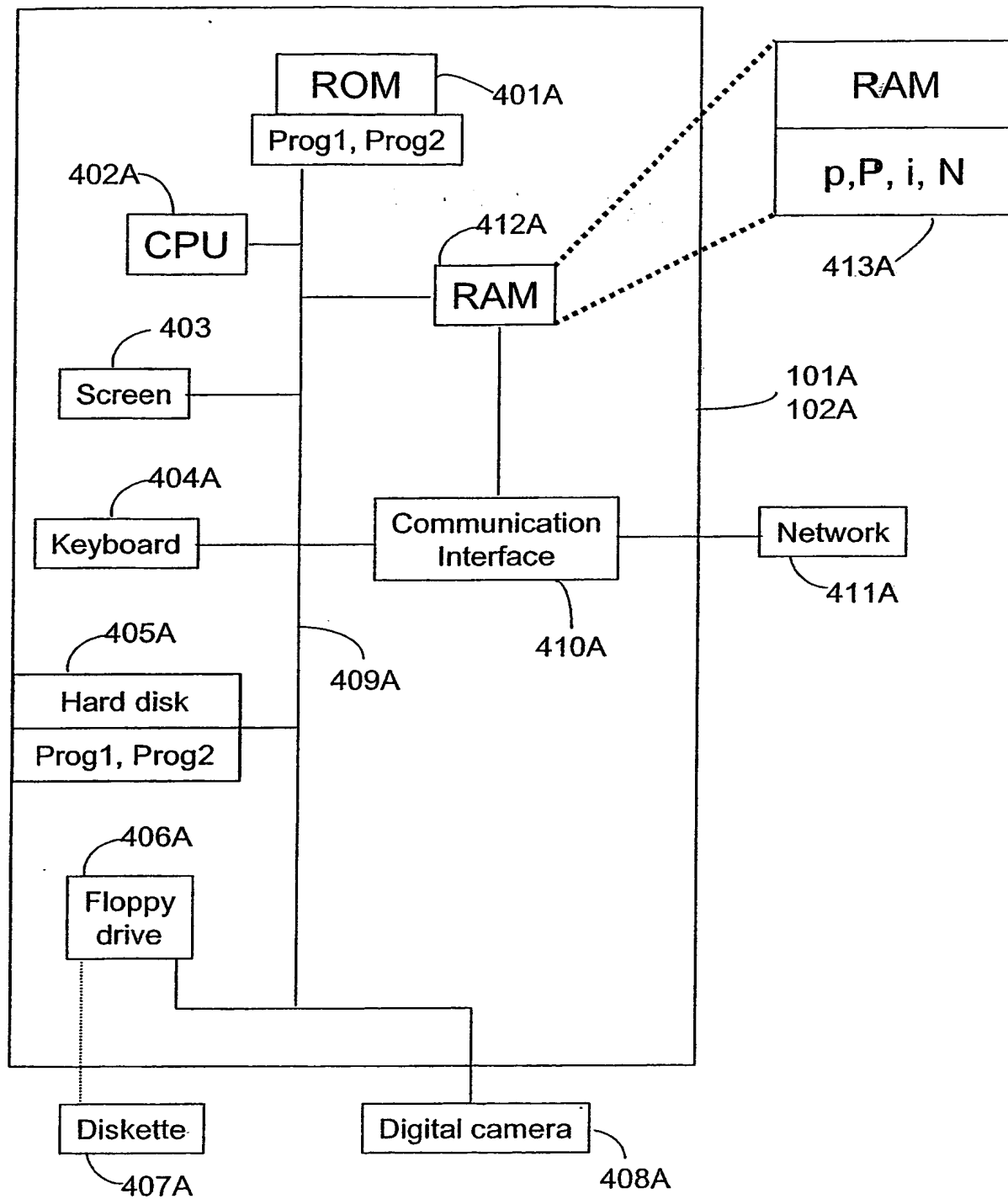


FIG. 4A

**THIS PAGE BLANK (USPTO)**

5/20

Table of documents		
Document Id	Version Id	Access path

Table of thumbnails		
String of characters	Version Id	Version Id

FIG. 5

**THIS PAGE BLANK (USPTO)**



6/20

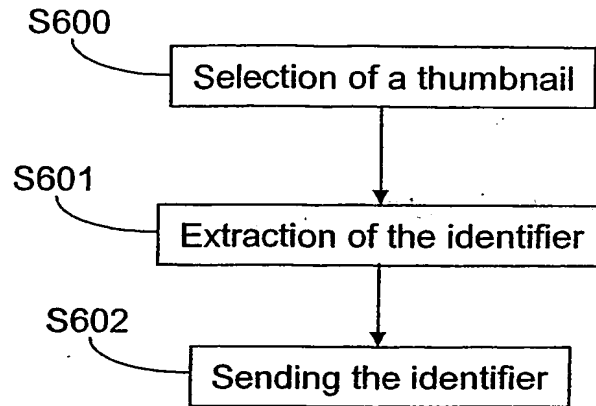


FIG. 6

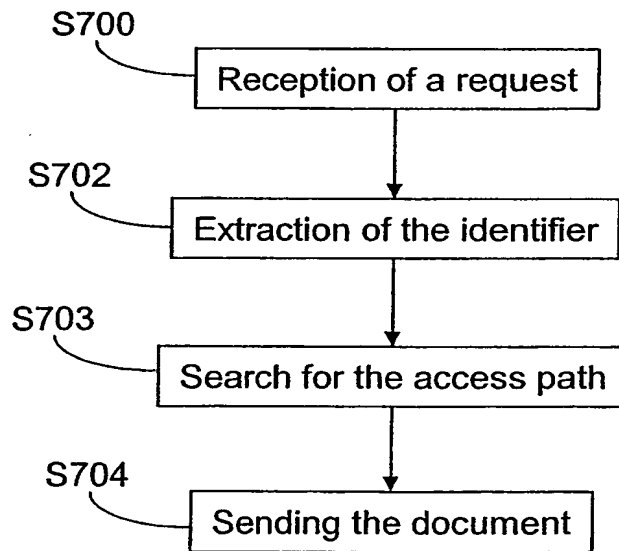


FIG. 7

**THIS PAGE BLANK (USPTO)**

7/20

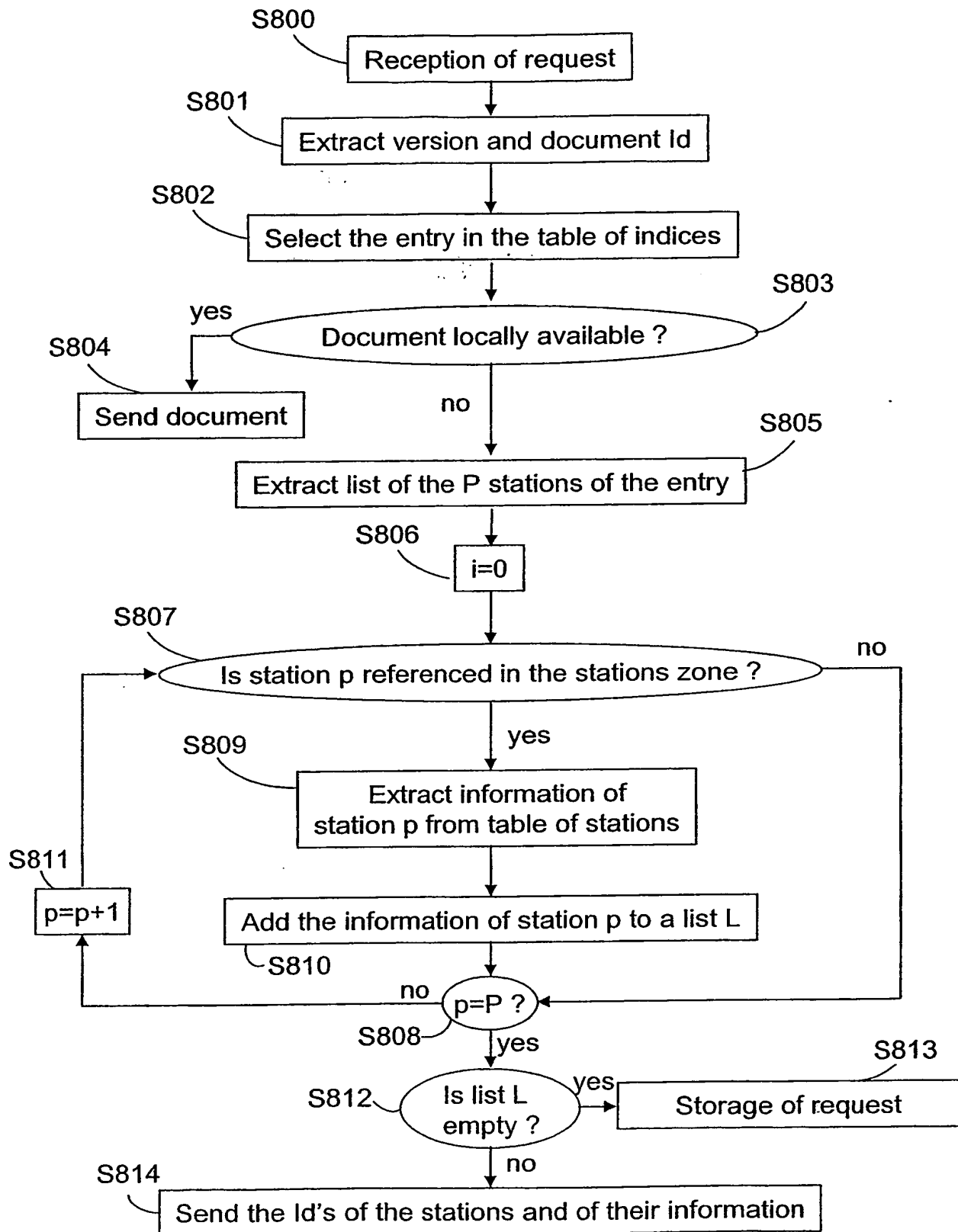


FIG. 8

**THIS PAGE BLANK (USPTO)**

8/20

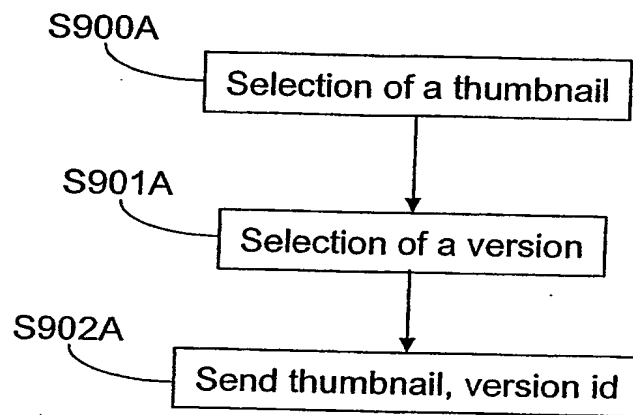


FIG. 9A

**THIS PAGE BLANK (USPTO)**

9/20

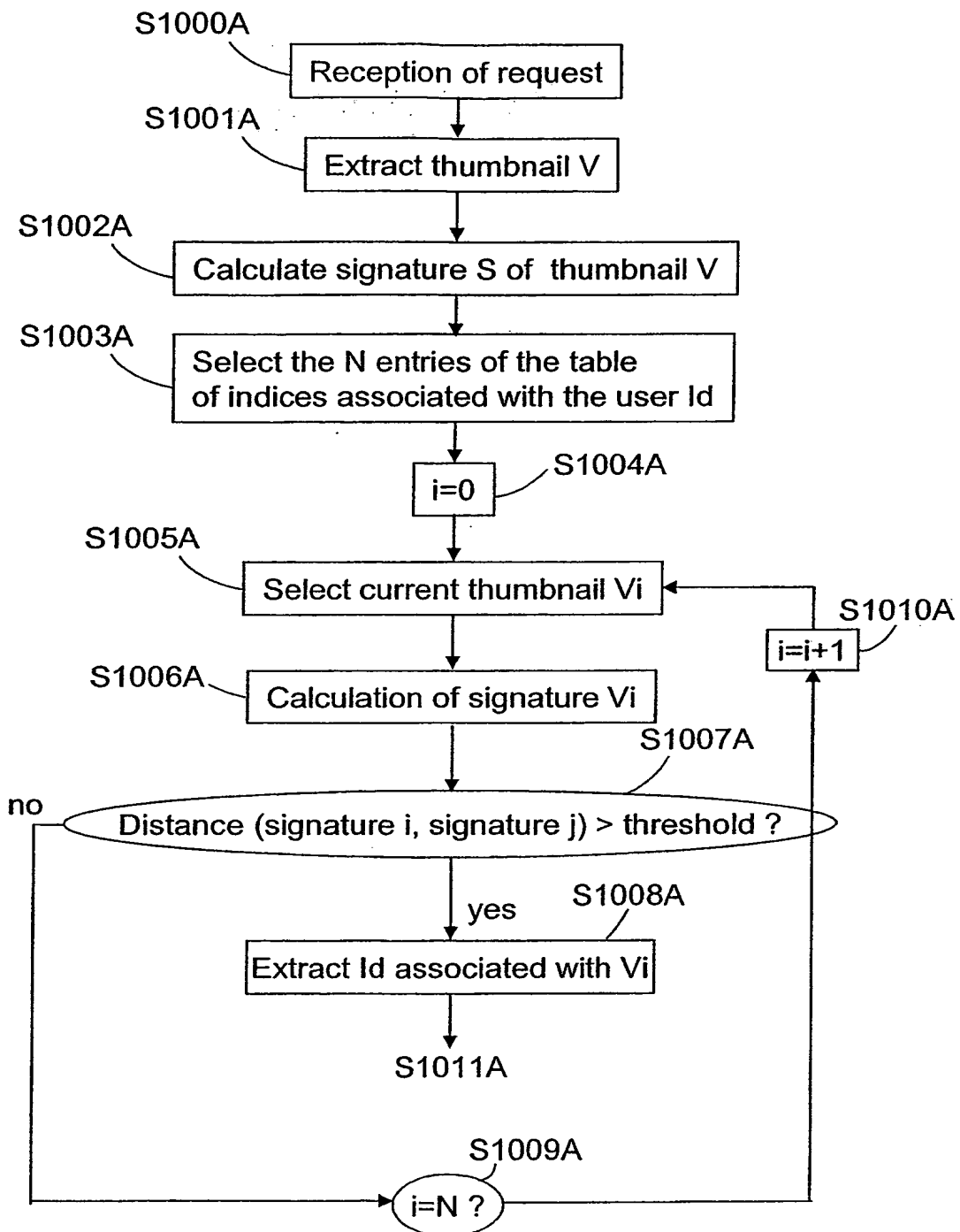


FIG. 10A

**THIS PAGE BLANK (USPTO)**



10/20

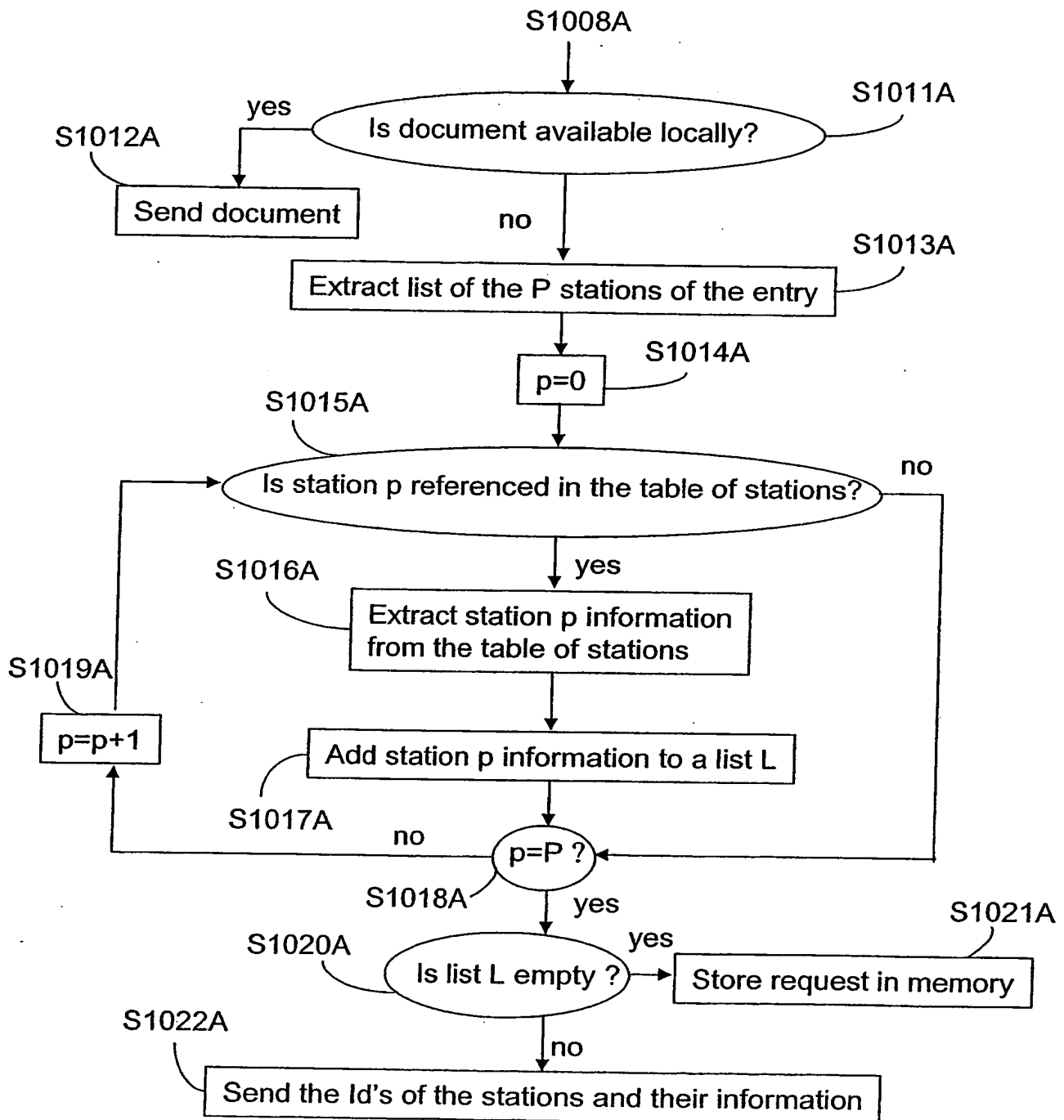


FIG. 11A

**THIS PAGE BLANK (USPTO)**

11/20

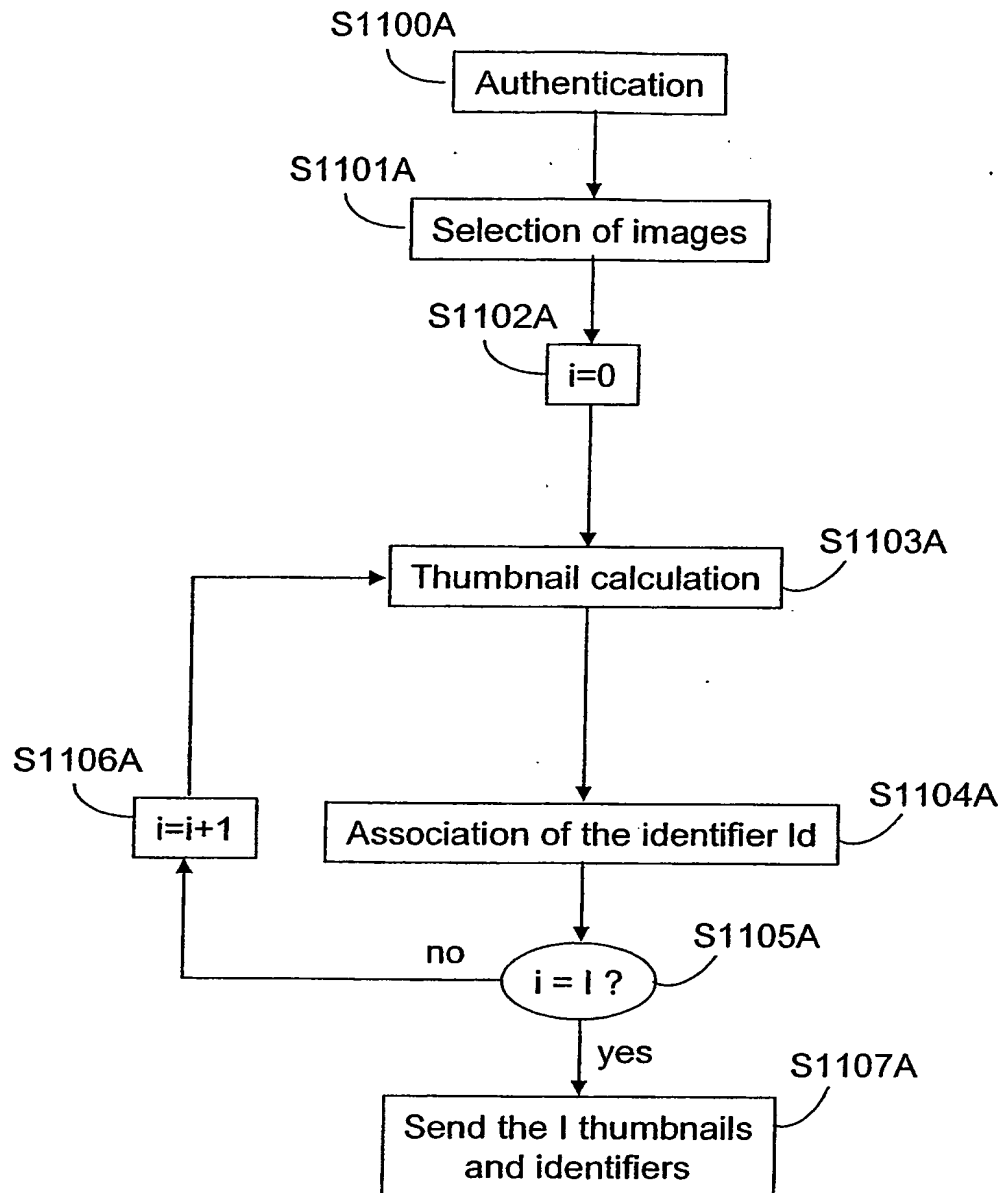


FIG. 12A

**THIS PAGE BLANK (USPTO)**

12/20

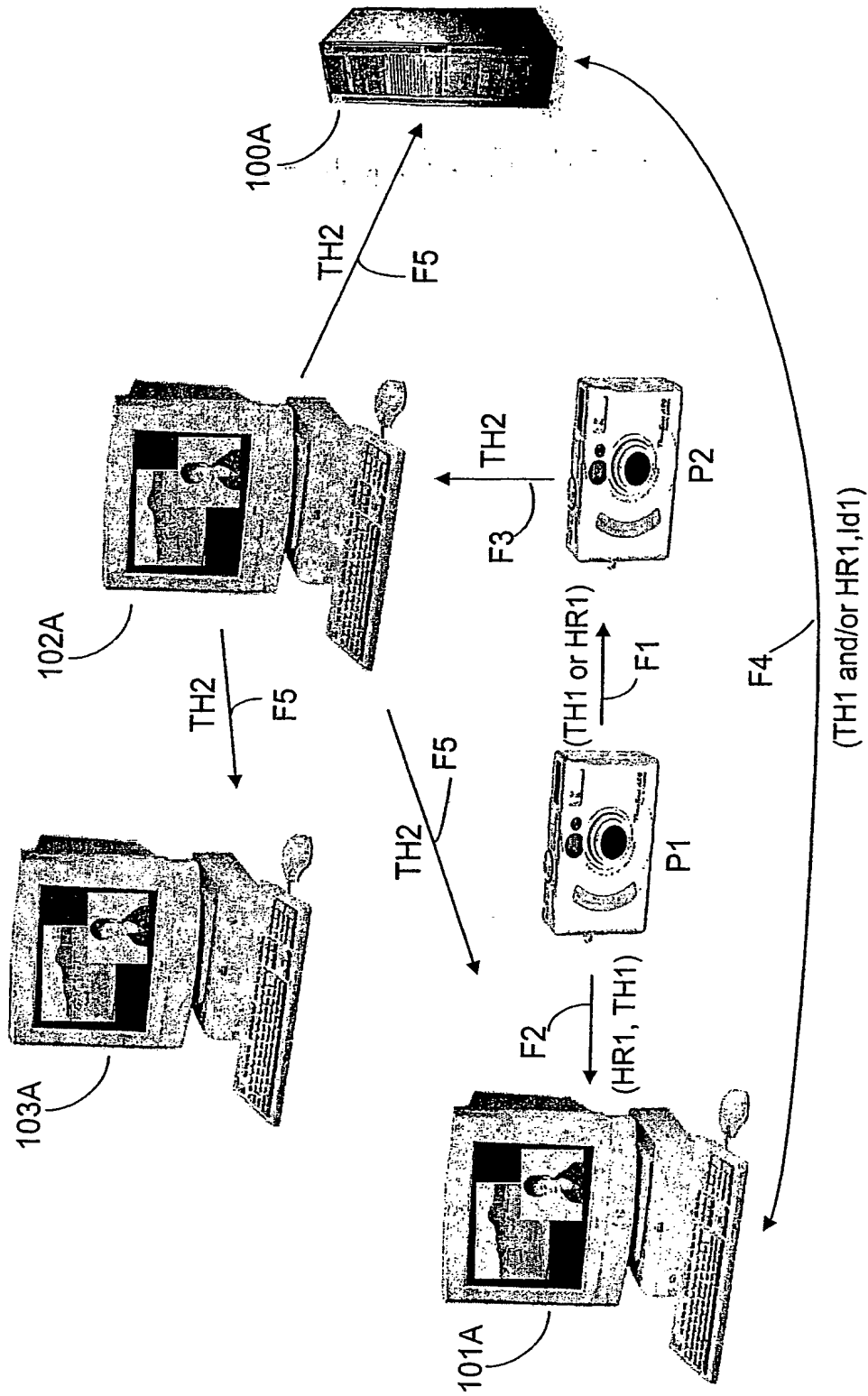


FIG. 13A

**THIS PAGE BLANK (USPTO)**

13/20

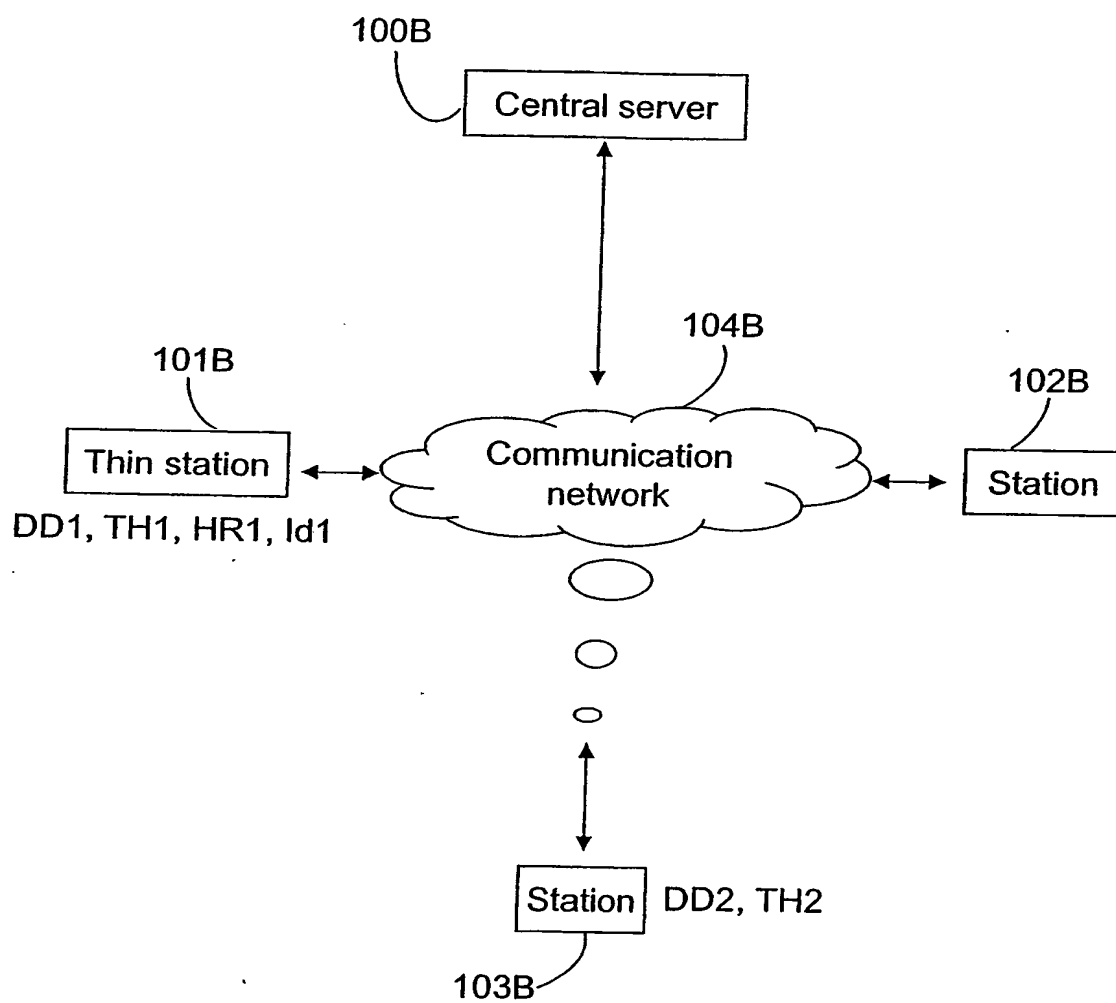


FIG. 1B

**THIS PAGE BLANK (USPTO)**



14/20

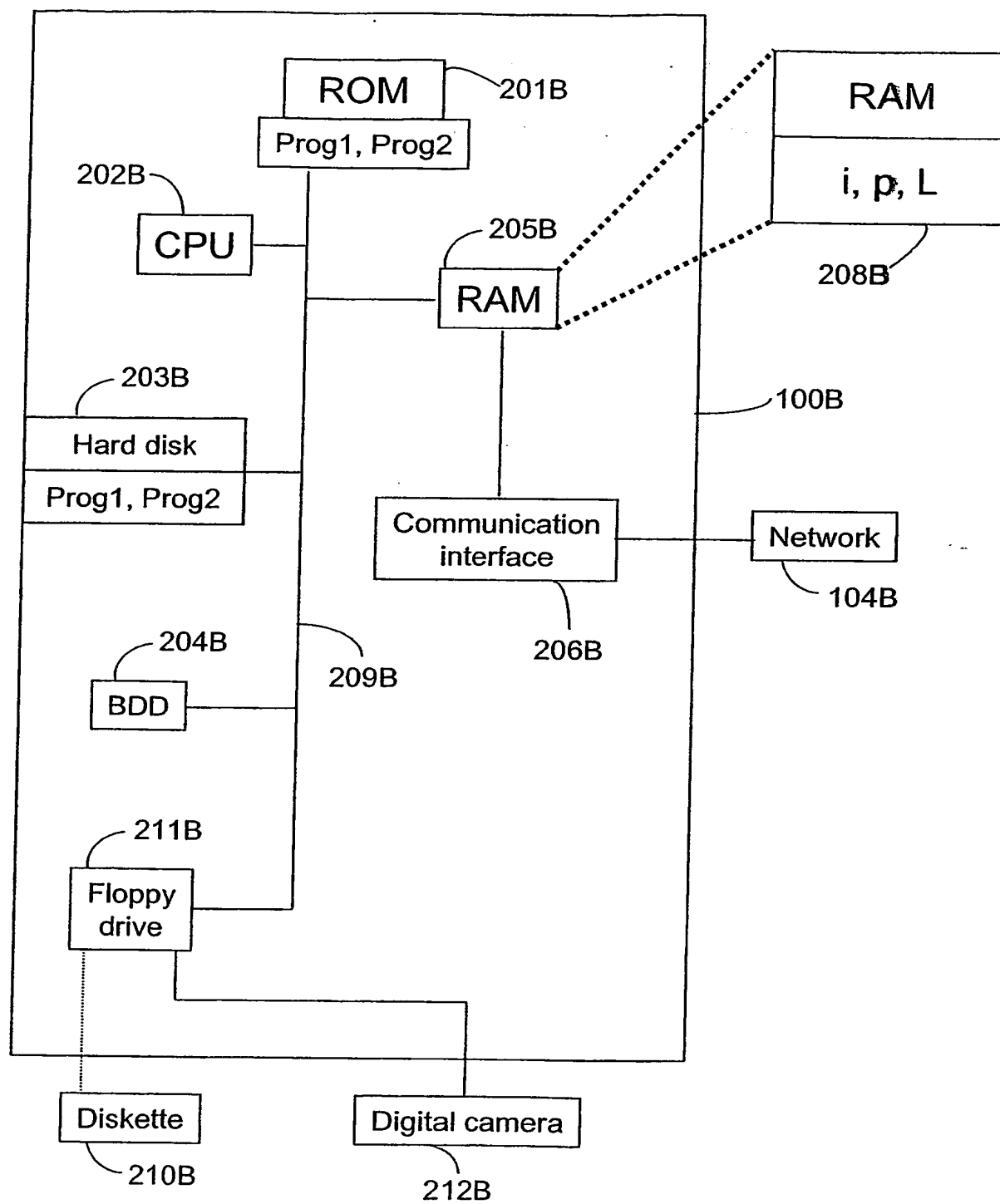


FIG. 2B

**THIS PAGE BLANK (USPTO)**

15/20

Table of users	
User Id	<ul style="list-style-type: none"><li>- Name</li><li>- Password</li><li>- Reference station Id</li></ul>

Table of stations	
Station Id	<ul style="list-style-type: none"><li>- Name</li><li>- IP address</li><li>- Port</li></ul>

Table of indices			
Document Id	Version Id	Station Id	Access path

FIG. 3B

**THIS PAGE BLANK (USPTO)**

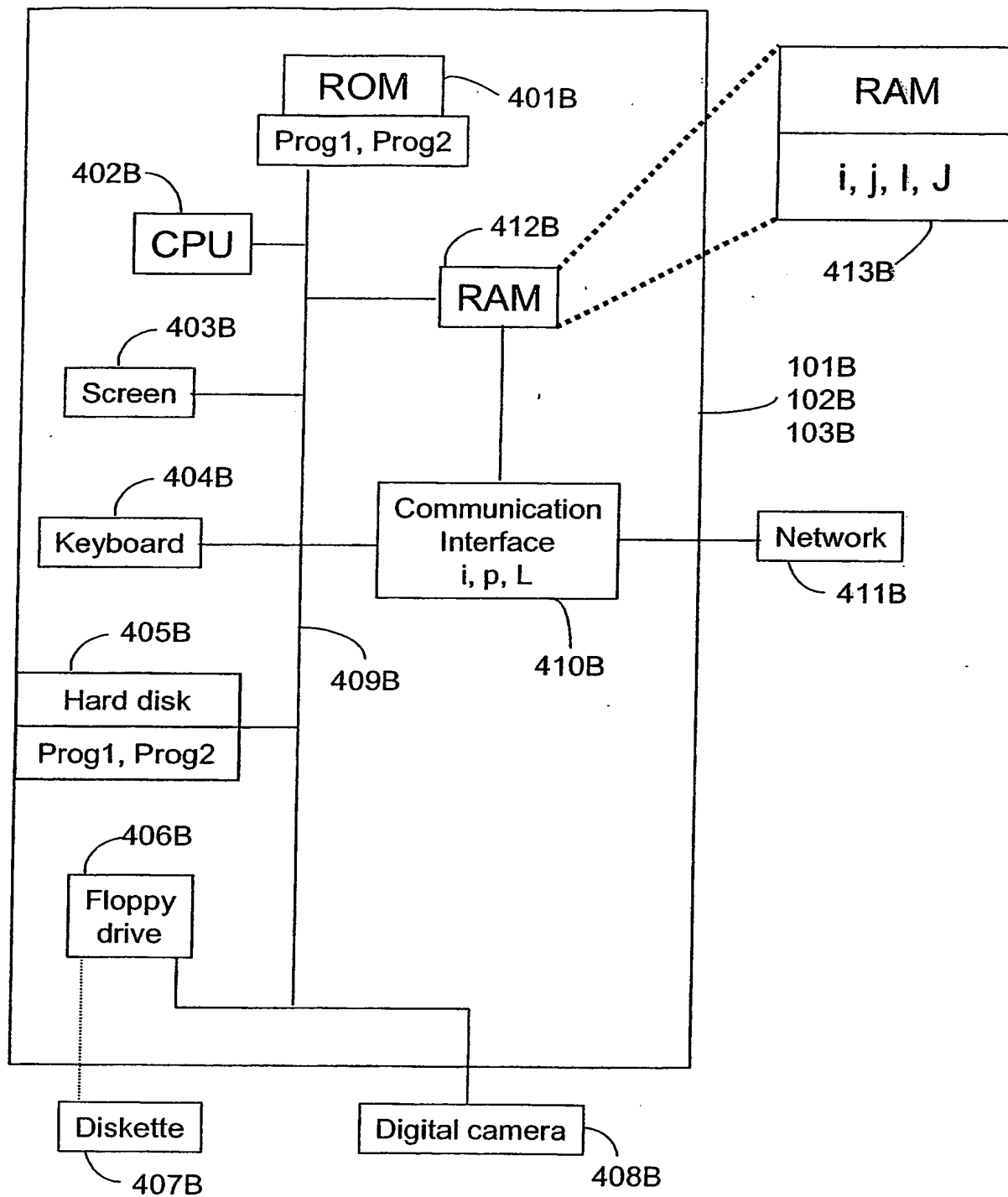


FIG. 4B

**THIS PAGE BLANK (USPTO)**

17/20

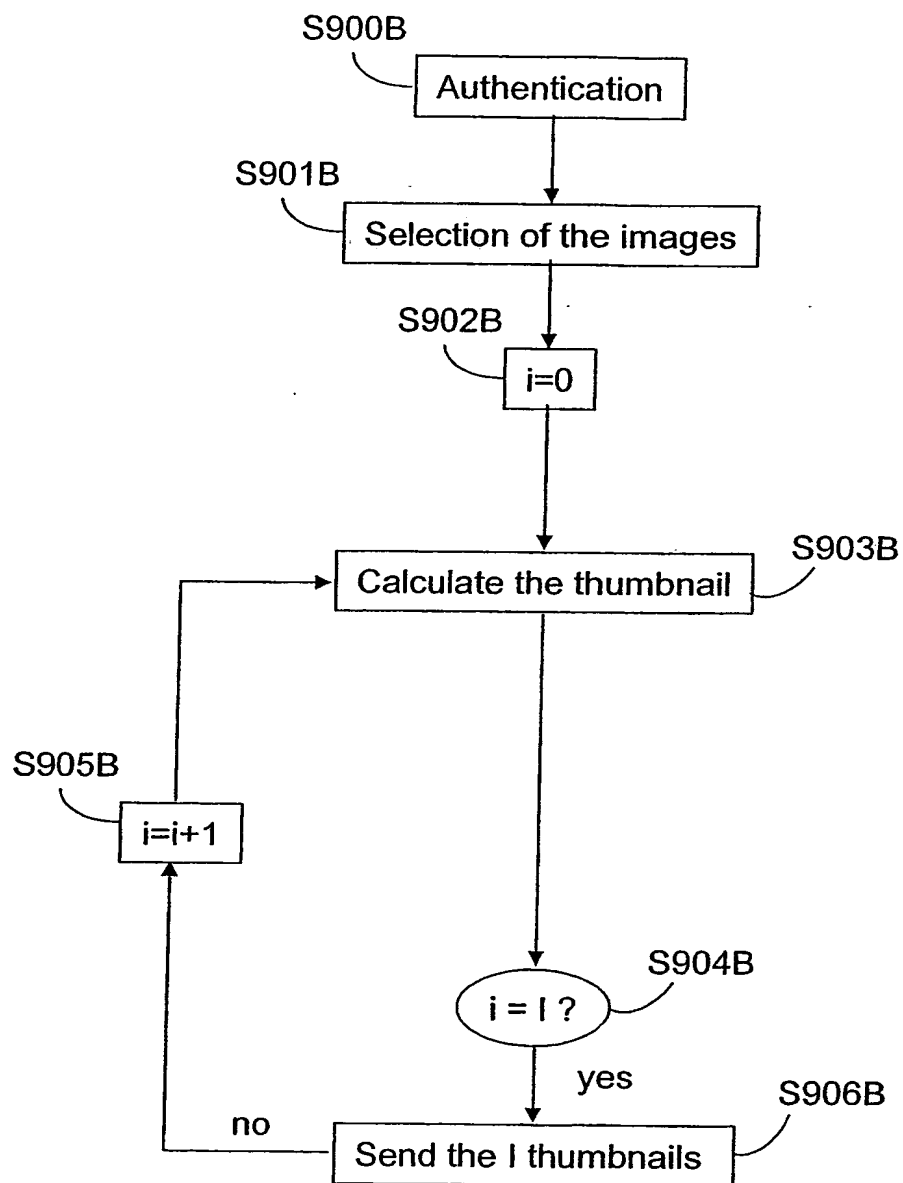


FIG. 9B

**THIS PAGE BLANK (USPTO)**



18/20

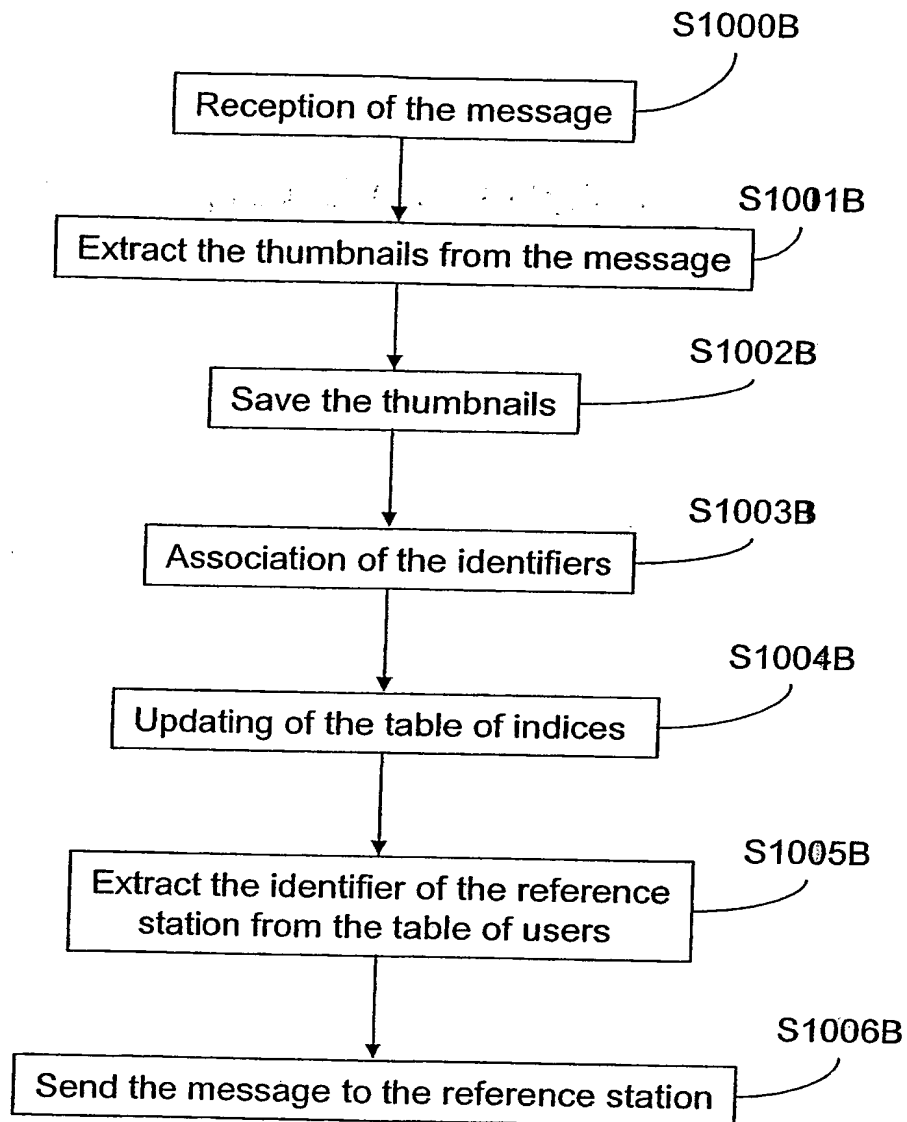


FIG. 10B

**THIS PAGE BLANK (USPTO)**

19/20

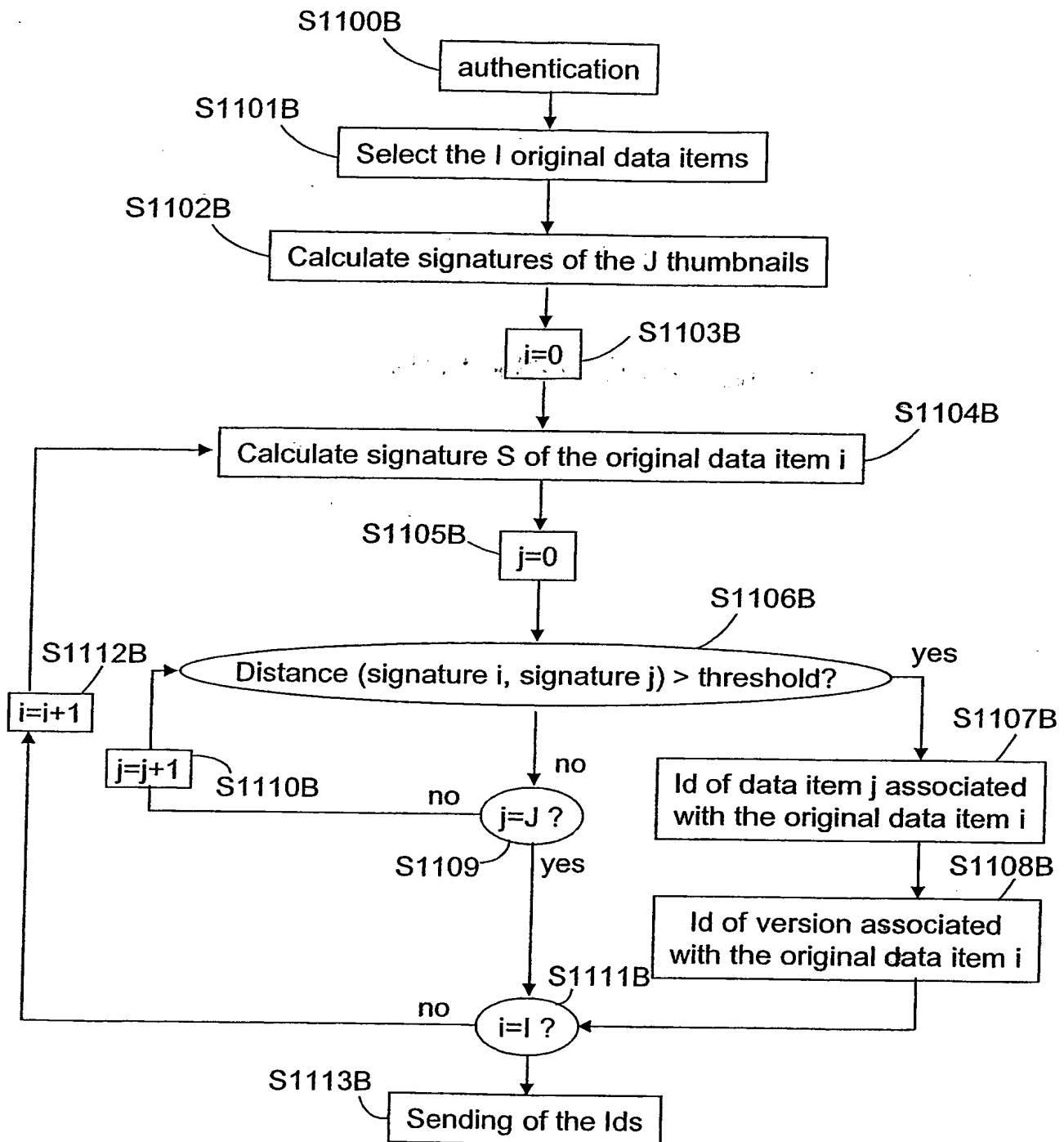


FIG. 11B

**THIS PAGE BLANK (ASPTO)**

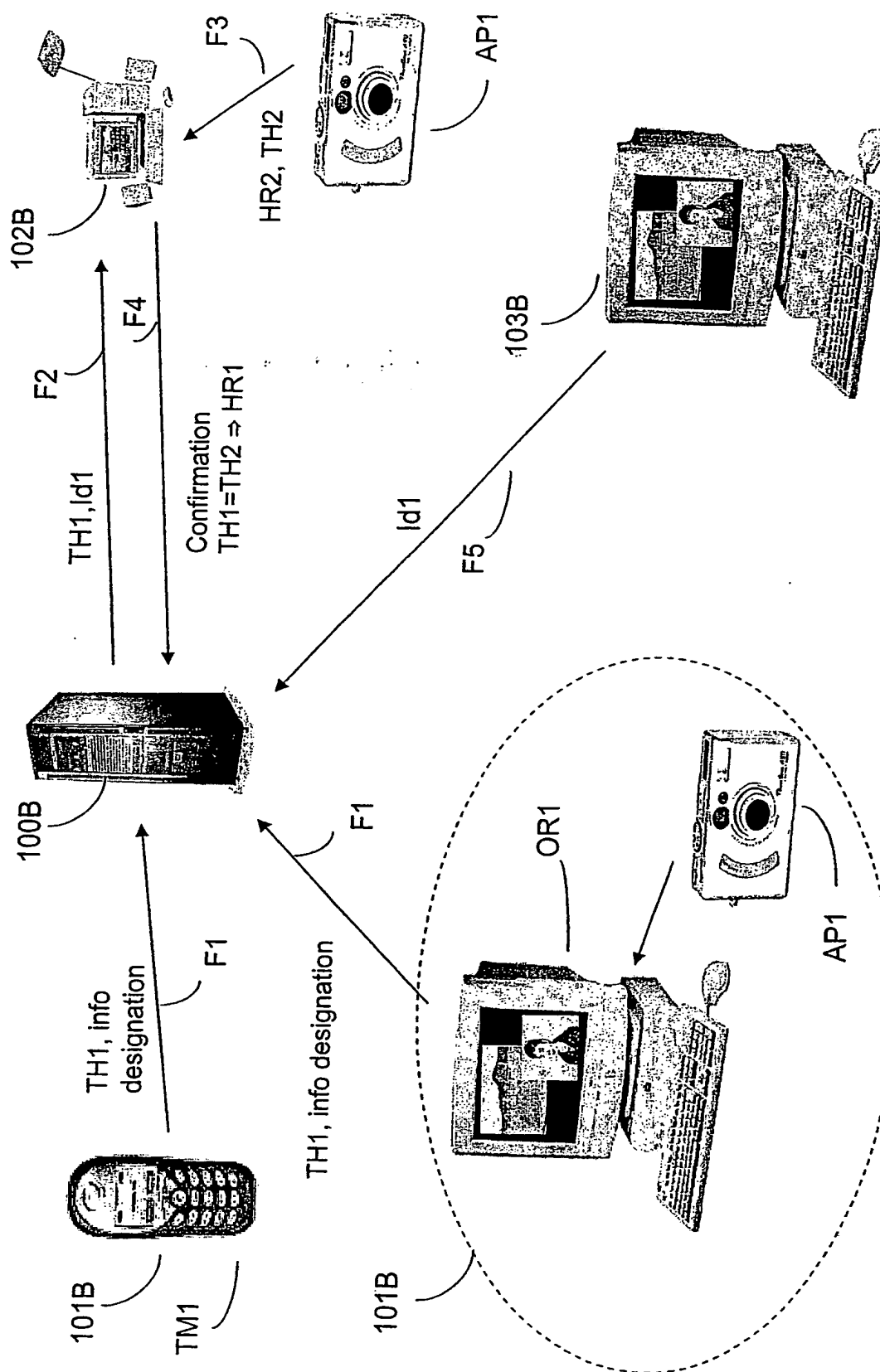


FIG. 13B

**THIS PAGE BLANK (USPTO)**

## INTERNATIONAL SEARCH REPORT

International Application No

.../IB2004/003883

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L29/08 G06F17/30 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L G06F H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, COMPENDEX, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	<p>EP 1 215 876 A (CANON KK) 19 June 2002 (2002-06-19) figure 1</p> <p>figure 3 figure 5 figure 6 figure 7 paragraph '0019! paragraph '0038! paragraph '0062! paragraph '0066! - paragraph '0067! paragraph '0071! paragraph '0074! - paragraph '0082! paragraph '0096! - paragraph '0097! paragraph '0101! - paragraph '0102!</p> <p style="text-align: center;">----- -/-</p>	<p>8,11,14</p> <p>1-7,9, 10,12, 13,15</p>

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*G\* document member of the same patent family

Date of the actual completion of the international search

14 February 2005

Date of mailing of the international search report

25/02/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Jeampierre, G

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	<p>US 2003/011683 A1 (YAMASAKI FUMITOMO ET AL) 16 January 2003 (2003-01-16) figures 1,17-19,21</p> <p>paragraph '0002! paragraph '0011! - paragraph '0012! paragraph '0052! paragraph '0055! paragraph '0057! - paragraph '0059! paragraph '0137! - paragraph '0138! paragraph '0142! - paragraph '0143! paragraph '0149! paragraph '0160! - paragraph '0161! paragraph '0189!</p>	<p>8,11,14</p> <p>1-7,9, 10,12, 13,15</p>
X A	<p>US 2003/063771 A1 (MORRIS ROBERT PAUL ET AL) 3 April 2003 (2003-04-03) figure 1</p> <p>paragraph '0002! paragraph '0011! paragraph '0015! paragraph '0017! - paragraph '0020!</p>	<p>8,11,14</p> <p>1-7,9, 10,12, 13,15</p>
A	<p>MICHAEL J. SWAIN: "Interactive INdexing into Image Databases" INTERNET ARTICLE, 'Online! 1993, pages 1-10, XP002286434 Retrieved from the Internet: URL:http://citeseer.ist.psu.edu/cache/papers/cs/3182/http:zSzzSzwww.cs.uchicago.edu/zSzzSzswainSzpubszSzspie93-image-db.pdf/swain93interactive.pdf&gt; 'retrieved on 2004-06-29! abstract page 1, paragraph 3 page 2, paragraph 3</p>	<p>1-7,9, 10,12, 13,15</p>
A	<p>STONE H S: "Fourier-wavelet techniques in image searching" CIRCUITS AND SYSTEMS, 1997. ISCAS '97., PROCEEDINGS OF 1997 IEEE INTERNATIONAL SYMPOSIUM ON HONG KONG 9-12 JUNE 1997, NEW YORK, NY, USA, IEEE, US, 9 June 1997 (1997-06-09), pages 1472-1475, XP010236364 ISBN: 0-7803-3583-X figure 1 figure 2 abstract page 1472, column 2 - page 1473, column 2</p>	<p>1-7,9, 10,12, 13,15</p>



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

.../IB2004/003883

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 1215876	A	19-06-2002	JP	2002183167 A		28-06-2002
			EP	1215876 A1		19-06-2002
			US	2002075392 A1		20-06-2002
US 2003011683	A1	16-01-2003	CN	1398111 A		19-02-2003
			JP	2003092719 A		28-03-2003
US 2003063771	A1	03-04-2003	US	2003063770 A1		03-04-2003
			AU	2003234714 A1		27-10-2003
			EP	1497755 A1		19-01-2005
			WO	03088089 A1		23-10-2003
			WO	03030034 A1		10-04-2003
			US	2004215625 A1		28-10-2004



**THIS PAGE BLANK (USPTO)**